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MASON (F. R.). **Annual Report of the Department of Agriculture and Fisheries (Palestine) for the Year ended March 31, 1945.**—16 pp. Jerusalem, 1946.

This report includes notes (pp. 14–15) on insect pests of crops in Palestine during the year ending 31st March 1945. *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.) continued to be a major pest of *Citrus* [*cf. R.A.E.*, A **25** 257], and some groves suffered from widespread dieback as a result of the attack. Good results were obtained with an oil spray, but a large number of sprayers would be required to treat any considerable area, as the suitable period for treatment is limited to about 60 days in the year. Infestation by the mealybugs known locally as *Pseudococcus comstocki*, Kuw. [*cf.* **32** 85] was still widespread. It caused little damage, but constitutes a problem for exporters of *Citrus* fruits, owing to quarantine regulations. The Encyrtid, *Clausenia purpurea*, Ishii [*cf.* **31** 440] gave control and mass liberations were made in recently infested groves. No effective means had been found of controlling Buprestids of the genus *Capnodis* [*cf.* **35** 214], which were still very injurious to deciduous fruit trees. *Eriosoma lanigerum*, Hsm., was being successfully controlled on apple by the parasite, *Aphelinus mali*, Hald. [*cf.* **27** 127]; the addition of nicotine sulphate to alternate sprays of lead arsenate used against the codling moth [*Cydia pomonella*, L.] gave effective supplementary control. Widespread damage was caused in wheat fields by larvae of *Syringopais temperatella*, Led., against which the introduction of a leguminous crop into the cereal rotation is advised. Surveys of potato plots that were established in preliminary experiments to investigate the causes of the abnormally rapid degeneration of seed in Palestine showed only a few Aphids, none of which was identified as *Myzus persicae*, Sulz. Potatoes and other vegetables were severely attacked by the cutworm, *Prodenia litura*, F., but it was controlled by poison baits and by improved field sanitation.

SLOAN (W. J. S.). **The Status of Heat Treatment of Plant Cotton Seed for the Control of Pink Bollworm, *Pectinophora scutigera* Hold., in Queensland.**—*Qd J. agric. Sci.* **3** no. 1 pp. 80–85, 3 refs. Brisbane, 1946.

The author describes an investigation carried out at a ginnery in 1941 to ascertain whether the heat treatment applied in Queensland to cotton seed intended for planting to free it from infestation by *Platyedra* (*Pectinophora*) *scutigera*, Hold., is necessary. Samples were collected from the seed stream after cleaning but before heating, and from the bags in which the seed was stored. Over 98,000 seeds were examined individually, of which 28·3 per cent. were classed as defective through various causes, but no double seeds, which are characteristic of resting larvae of *P.* (*P.*) *gossypiella*, Saund., and only two dead larvae of *P. scutigera* were found. One sample of stored seed was infested with *Ephestia cautella*, Wlk., and *Tribolium castaneum*, Hbst., but it had been kept near oil-mill seed, which is usually infested by these insects.

It was concluded that infestation by *P. scutigera* is not heavy in plant seed from high-grade seed cotton; that any larvae present are almost all removed during the various cleaning processes [*cf. R.A.E.*, A **31** 265]; and that heat treatment of the cleaned seed is therefore superfluous. The absence of larvae in the seed indicates that *P. scutigera*, unlike *P. gossypiella*, Saund., does not form a larval resting stage within the seed, though it does have a prolonged larval stage in winter, since larvae collected in late autumn and early winter and kept with dry undelinted seed and débris did not pupate for periods as long as 16 weeks. The investigation emphasises the importance of field sources of infestation of which the chief are ratoon or standover cotton, undestroyed crop residues and wild Malvaceous plants [*cf.* **14** 459] while sheds and railway trucks used in the storage and transport of cotton may be minor sources.

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May (A. W. S.). **Pests of Cucurbit Crops.**—*Qd agric. J.* **62** pt. 3 pp. 137–150, 10 figs. Brisbane, 1946.

A key is given to the chief pests of cucurbits in Queensland, with notes on their bionomics and control. The Galerucids, *Aulacophora* (*Ceratia*) *hilaris*, Boisd., and *A.* (*Rhaphidopalpa*) *abdominalis*, F., which have similar life-histories, and the Coccinellid, *Epilachna vigintioctopunctata*, F., are the only ones likely to attain pest proportions each year in all parts of Queensland. The Galerucids are particularly injurious to seedlings, flowers and small fruits; the adults overwinter, and often attack spring plantings shortly after germination, when relatively few can defoliate and destroy the seedlings. Plants that have formed runners are usually free from this danger [*cf. R.A.E.*, A **30** 498]. Beetles feeding on the flowers interfere with fruit setting, and young fruits that have been eroded on the surface may wither and fall. The larvae feed on the roots, which become misshapen, and penetrate the surfaces of fruits in contact with the soil. Eggs are laid singly or in small groups on dead leaves or on small clods under the plants; the larvae hatch in about ten days, feed for about five weeks, and pupate in the soil. The beetles can be killed by a dust of lead arsenate and lime or kaolin (1 : 3) or a spray of 1½ lb. lead arsenate in 50 gals. water; the dust should be used on seedlings as it also acts as a repellent and so reduces reinfestation. Seedlings require treatment at intervals of 5–7 days if infestation is severe.

The foliage of cucurbits, potatoes and several weeds may be damaged or destroyed by larvae and adults of *E. vigintioctopunctata*, all stages of which may occur together. The life-cycle is completed in about four weeks; eggs are laid on the under surface of the foliage or developing fruit [*cf.* **28** 513], and the larvae pupate on or near the food-plant. Control can be obtained by thorough applications of lead-arsenate dusts or sprays, but the accumulation of residues on the fruit should be avoided; sprays or dusts containing 0·1 or 2 per cent. DDT, respectively, may be used until three weeks before harvesting begins. The larvae of the Pyralid, *Margaronia* (*Phacellura*) *indica*, Saund., attack most cucurbit crops, but are commonest on watermelon. They feed on the lower surface of the leaves, which are lacerated and bound together by silk threads; in severe outbreaks most of the foliage is destroyed and the larvae then burrow in the stems. The fruits are sometimes eroded, particularly at the stem end. The eggs are laid singly on the lower surfaces of the leaves, and the larvae pupate in silken cocoons inside shelters of tied leaves. The larval and pupal stages last about three weeks and five days, respectively. Lead-arsenate sprays or dusts give good control, and dusts or sprays of DDT should also prove effective.

Outbreaks of *Aphis gossypii*, Glov., cause leaf-curl of seedlings and an eventual reduction of the yield and should be controlled in the early stages of plant growth by sprays containing ½ pt. nicotine sulphate and 2 lb. soft soap in 50 gals. of water or dusts containing 3 per cent. nicotine. Regular applications of these dusts or sprays will control *Thrips tabaci*, Lind., which occurs on many cucurbits and is particularly injurious to young cucumbers. All cultivated cucurbits are attacked by *Tetranychus telarius*, L. (*urticae*, Koch), particularly in spring and summer. Severe infestation causes chlorosis and death of the leaves and weakens the plants. The eggs, which are laid on the lower surface of the leaves, hatch in 4–5 days, and the life-cycle is completed in less than two weeks in summer. Control can be obtained by sprays of lime-sulphur (1 : 60) or wettable sulphur or, preferably, dusts containing at least 30 per cent. sulphur applied to reach the lower surface of the leaves. Weeds on which the mites breed should be destroyed.

Adults of the Lamiid, *Apomecyna histrio*, F., which occur on most cucurbit crops and have been reared from larvae in the stems of melons, pumpkins and vegetable marrow, cause unimportant injury by eroding the bark of growing

plants. Eggs are laid singly in growth cracks or other scars along the stems, and the larvae feed and pupate in them. It is thought that there may be two or three generations a year. Normally plants grown under favourable conditions can withstand very heavy stem infestation, although crops of rock melon are probably reduced. The risk of infestation may be reduced by burning the remains of crops after harvesting. The bugs that are sometimes injurious to cucurbits include the Pentatomids, *Nezara viridula*, L., and *Megymenum insulare*, Westw., and the Coreid, *Leptoglossus bidentatus*, Montr. *Nezara* and *Leptoglossus* attack plants of various families, but cucurbits are the main food-plant of *M. insulare*. Control of these bugs is difficult owing to the protection afforded by the dense foliage ; recent work [*cf.* **34** 386 ; **35** 159] suggests that a spray containing 0·1 per cent. DDT will be more effective than the insecticides formerly used. *Dacus* (*Austrodacus*) *cucumis*, French, which also attacks tomatos, usually infests the fruits of cucurbits when they are mature or damaged and so attracts attention at harvest. Some eggs are laid in immature fruits, however, when the flies are abundant, and though they do not hatch, calloused areas, subsequently associated with deformities, appear in the rind round the oviposition punctures. The whole life-cycle may be completed in about a fortnight. Control can be effected only by the regular removal and destruction of all fruits in which the fly can breed.

The severity of insect attacks can be mitigated by measures that promote vigorous growth of the plants. Since the importance of the different pests varies with the locality, a basic control programme should be evolved for the species normally encountered in particular districts, special treatments being reserved for those that occur less frequently. Applied at weekly intervals soon after the seedlings appear, a dust of lead arsenate, copper carbonate, sulphur and kaolin (5 : 3 : 6 : 6) will give protection against leaf-eating insects, downy mildew [*Pseudoperonospora cubensis*] and *T. telarius*. A combined spray containing lead arsenate, cuprous oxide mixture and sulphur may also be used, but is inferior to the dust in insecticidal value. The copper fungicide may be omitted from the dust or spray for treatment of crops other than rock melons and cucumbers, which are very susceptible to downy mildew, and the sulphur in districts where attack by *T. telarius* is unusual ; in the case of the dust, the amount of kaolin should be increased accordingly.

Sloan (W. J. S.). **The Fruit Spotting Bug.**—*Qd agric. J.* **62** pt. 4 pp. 229–233, 4 figs. Brisbane, 1946.

Although the Coreid, *Amblypelta lutescens*, Dist., attacks many different plants in Queensland, it is best known as a pest of papaya [*Carica papaya*] in the central and northern coastal districts, where plantations near standing scrub are particularly liable to infestation. Injury is most severe on trees less than nine months old, and is sometimes fatal to seedlings. Damage to the growing tip is most serious ; sap exudes from each feeding puncture, and the surrounding plant tissue becomes depressed and fissured. Small lumps of congealed latex on the growing tip are usually an early symptom of infestation. The terminal growth of trees injured in this way consists of a dense bunch of leaves with short, distorted stalks. Where the terminal is killed, side shoots are usually formed and develop normally if not infested ; moderately injured terminals recover in favourable conditions. Trees that have begun to flower are not seriously affected, but green and ripe fruits may be injured, showing a depressed, discoloured lesion at each puncture. Vigorous, bearing trees withstand relatively heavy infestation without displaying marked abnormalities in growth. Injury to the vegetative growth, similar to that on papaya, is caused on cassava and frangipanni [*Plumeria*], whereas spotting of the fruits is more characteristic of the damage on custard apple [*Annona squamosa*],

banana, passion fruit [*Passiflora edulis*], granadilla [*P. quadrangularis*], pine-apple, beans and mango ; other food-plants of the Coreid include *Peltophorum* and native trees such as white cedar [?*Melia dubia*] and the rough-leaved fig [*Ficus aspera*]. The severe reaction of papaya trees to very light infestation suggests that the insects introduce plant toxins as they feed. The nymphs appear to be more injurious than adults, probably because they feed continuously on the tree on which they hatch, whereas the adults may fly from tree to tree. The eggs are normally laid singly on papaya leaves, particularly on older ones ; the nymphs hatch in 4–6 days in warm weather and mature in 4–6 weeks, and the adults live for at least four weeks. Both nymphs and adults feed on the tender growth ; they are usually most numerous in autumn, but severe outbreaks may occur at any time except in the winter months. On established trees that have survived injury to the terminals, feeding scars and swollen areas with short intermodes on the stem indicate the height of the plant when attacked.

Since the age and vigour of a plant seem to determine its susceptibility, good growing conditions should be maintained in the seedling stage and for at least nine months after planting out. The plantations should be at least half a mile from standing scrub, which may act as a source of infestation. Hand-picking of the insects gives some protection until the trees are old enough to withstand attack. Frequent examination of the plantations should be made throughout the year to ascertain whether control is necessary, and the tops of any seriously injured trees should be removed with a sharp knife. Fortnightly applications of a 5 per cent. nicotine dust or a dust of equal parts of ground pyrethrum flowers and kaolin have shown considerable promise in preliminary field trials, and it is thought probable that sprays and dusts containing DDT will also give useful control.

Lloyd (N. C.). **Insecticidal Control of the Potato Moth. Promising Results with D.D.T. Recent Experiments surveyed.**—*Agric. Gaz. N.S.W.* **57** pt. 5 pp. 229–233. Sydney, 1946.

The results are given of field experiments against *Gnorimoschema operculella*, Zell., on potato carried out in New South Wales in 1944–46 to find an insecticide that would eliminate infestation in the foliage so that subsequent infestation of the tubers would not occur. Experiments in 1942 and 1943 having shown that derris, either as a dust or spray, was the best insecticide then available [*cf. R.A.E.*, A **33** 185], field tests on areas of about an acre were carried out with dusts containing derris and kaolin (1 : 4) and sprays containing 3 lb. derris and 3 lb. soft soap in 100 gals. of water, both of which reduced breeding in the foliage to a considerable extent but did not prevent subsequent infestation of the tubers. This tuber infestation is attributed partly to moths from larvae that survived the treatments and partly to moths coming from outside the treated areas. In view of the promising results obtained with DDT [*cf.* **34** 382 ; **35** 160, 161], field-scale tests were carried out in the spring of 1945, in which a dust containing 2 per cent. DDT (98 per cent. p,p′ isomer) was applied to infected plants from a power dusting machine. Four or five applications, at intervals of 14 days and at dosages of 46·5 or 60 lb. per acre respectively, caused almost complete elimination of breeding in the foliage ; subsequent tuber infestation was very low, but it was not much higher in neighbouring untreated areas in that season. Further tests were carried out with the 2 per cent. dust in 1946, when three applications were made, each at a rate of 60·5 lb. per acre, to a patch in which the leaves of the plants were lightly infested and the moths were numerous ; it was separated by at least 500 yards from the nearest untreated patch. Within five weeks, foliage infestation had been almost completely eliminated, whereas it had increased very considerably in untreated patches. When the experimental patch was dug there were about 50 adult moths under 50 plants as compared with at least ten times as many in untreated

patches, and the percentage of tubers infested, excluding those that had protruded through the soil and become green through exposure, was only 2·4 as compared with 33 and 40 in adjacent untreated areas. The yield averaged four tons per acre, of which it was estimated that one ton had been saved by dusting. Practically identical results were obtained in a concurrent experiment, in which the dust was applied at 55 lb. per acre to a patch of plants only 200 yards away from the nearest untreated area.

In future experiments, treatment will begin as soon as the pest appears, and will be repeated 10–14 days later. In this way it is hoped to prevent infestation of the foliage from developing, and, in view of the smallness of the plants so early in the season, it is thought that a dosage of only 40 lb. per acre should be sufficient. Moreover, since small-scale tests have shown that a dust containing 1 per cent. DDT is as effective as the 2 per cent. dust, further economy may be possible in the use of the lower concentration. The necessity for covering the plants thoroughly with the dust, isolation of the treated patches, and the removal of self-sown plants is stressed.

KOZHANCHIKOV (I. V.). **On the lower thermal Limit in the Development of Insects.**—*C. R. Acad. Sci. URSS* (N.S.) **51** no. 3 pp. 241–244, 1 graph, 12 refs. Moscow, 1946.

In order to study certain aspects of the theory of thermal thresholds of development in insects, the effect of temperature on the development of pupae of *Musca domestica*, L., was investigated. When the pupae were kept at constant temperatures, none survived at 10 or 36°C. [50 or 96·8°F.], and the duration of development ranged from 36–37 days (with 85 per cent. mortality) at 13·5°C. [56·3°F.] to 4 days (with 12 per cent.) at 34·5°C.[94·1°F.]. There was no mortality at 20 or 25°C. [68 or 77°F.], at which development was completed in 8·7 and 6 days, respectively. Pupae kept at temperatures of 0–5°C. [32–41°F.] for 1–10 days and then at 25°C. completed their development at the higher temperature in about 6 days, but if the initial temperature was 10°C., the subsequent development period was slightly reduced when the exposure period lasted 1–2 days, but increased when it lasted 3–6 days. In general, mortality increased with the duration of exposure to the lower temperature. The author concludes that there is a thermal threshold a little above 5°C. below which developmental processes cease completely, and a thermal limit a little above 10°C., below which they continue, but are not completed; the thermal limit is set by the exhaustion of the organism and the disturbance of the processes of development caused by low temperatures. In discussing his results with reference to the acceleration of development recorded by various investigators at alternating temperatures [*cf. R.A.E.*, A **29** 131, etc.], the author states that the period of development was shorter where the high temperature followed a low one than at the constant temperature corresponding to the average between them only where the low temperature was below the thermal limit, and that it was the same or longer where the low temperature was above the limit.

[IL'INSKAYA (M. I.).] ILJINSKAYA (M. I.). **The Mechanism of insecticidal Action and the Permeability of the Cuticle of Insects.**—*C. R. Acad. Sci. URSS* (N.S.) **51** no. 7 pp. 557–559, 5 refs. Moscow, 1946.

The results are given of studies on the relation between the toxicity of insecticides and the extent to which they can penetrate the insect cuticle. The insecticidal tests were carried out with *Macrosiphum sanborni*, Gill., and *Aphis pomi*, Deg., but as these Aphids are too small to use for permeability experiments, model systems prepared from empty skins of larvae of *Chironomus plumosus*, L.,

were employed in their stead. Toxicological experiments had shown that the cuticles of immature Aphids and larvae of *Chironomus* are similar in permeability. The larval skins, some of which were first rendered completely permeable by treatment with strong alkali, were filled with Protozoa (*Paramaecium*) and the effect on them of immersing the skins in solutions of the various insecticides was noted. The ability of each insecticide to penetrate is expressed by the co-efficient $K=C_1/C_2$, where C_1 and C_2 are the lowest percentage concentrations that killed the Protozoa in ten minutes in treated and untreated skins, respectively. The studies showed that the activity of an insecticide is determined by its ability to penetrate the insect cuticle (K figure) and its toxicity as a protoplasmic poison (C_1 figure). Two organic thiocyanates both gave complete mortality of *M. sanborni* at a concentration of 0·4 per cent., but one, for which K equalled 1 and C_1 equalled 0·35, killed 99 and 95 per cent. of the Aphids at concentrations of 0·2 and 0·1 per cent., respectively, and the other ($K=0·75$, $C_1=0·75$) killed only 81 and 64 per cent. at these concentrations. Alkaloids readily penetrate the cuticle in the form of undissociated molecules, but alkaloid cations penetrate only to a slight extent, if at all. Anabasine ($K=0·63$, $C_1=0·125$) gave 94 and 96 per cent. mortality of Aphids at concentrations of 0·1 and 0·2 per cent. ; it readily penetrates the cuticle in the form of a very slightly dissociated free alkaloid base. Anabasine sulphate ($K=0$, $C_1=7·5$) is strongly dissociated, however, and contains the alkaloid chiefly in the form of free cations ; it gave only 67 per cent. mortality of *A. pomi* at a concentration of 0·5 per cent. Alkalising a solution of anabasine sulphate increases its content of undissociated molecules of anabasine ; the addition of calcium hydroxide or sodium hydroxide (for both of which K was O and C_1 very low) to 0·25 per cent. anabasine sulphate increased the mortality of *A. pomi* from 46·3 to 82·1–90·2 and 86·5–92·2 per cent., respectively. These mortalities were given when sufficient alkali had been added to the solution to raise its pH to 10–10·5, at which it was most effective.

PAILLOT (A.). **La lutte contre la cochylis et l'eudémis de la vigne.**—*Ann. Epiphyt.* (N.S.) **8** fasc. 2 pp. 121–176, 24 figs., 34 refs. Paris, 1942.

An account is given of investigations carried out in France in 1939–41 on the bionomics and control of the vine moths, *Clysiana ambiguella*, Hb., and *Polychrosis botrana*, Schiff. The life-histories of the two species are reviewed, and the influence of climatic and meteorological factors on their development and abundance is discussed. The observations showed that the flight of the overwintered generation of *Clysiana* is chiefly conditioned by the average temperature prevailing in March, while that of *Polychrosis* is dependent on the temperature in late April and early May, during the last few days of pupal development. *Polychrosis* is the more sensitive to external conditions, especially temperature, but the eggs of both species are sensitive to heat, and the pupae can resist winter temperatures far lower than those encountered in the vineyards. Natural enemies, chiefly insect parasites of the larvae and pupae, afford considerable control but are not able by themselves to overcome an outbreak ; some of the adult moths are destroyed by birds. In the author's observations in the winter of 1940–41 at Saint-Genis-Laval, insect parasites and fungi accounted for more than 50 per cent. mortality of the cocoon population, but there was nevertheless a large flight of moths in the spring ; microsporidia [*cf. R.A.E.*, A **34** 32] and bacteria were not observed.

In experiments against the first generation, a spray of 1 per cent. lead-arsenate paste (15·3 per cent. As) in water or Bordeaux mixture, applied on 8th June 1939, gave considerable control, but was less effective than one of 0·4 per cent. nascent aluminium arsenate (13 per cent. As) in water, probably owing to the presence in the latter of a small quantity of soluble arsenic. A spreader was

included in all sprays, and the efficiency of lead arsenate was slightly reduced by admixture with Bordeaux mixture. In 1940, when two applications were made, on 25th May and 4th June, and calcium caseinate was added to all sprays, 1 per cent. synthetic cryolite (47 per cent. fluorine) in water was markedly superior to the same amount in Bordeaux mixture and to 0·5 per cent. aluminium arsenate or 0·75 per cent. calcium arsenate in Bordeaux mixture, but all these sprays were fairly effective. Experiments against the second generation, comprising one or two applications, were carried out in 1939 and 1940 in various districts. They showed that aluminium arsenate was better than lead arsenate in some cases though not in others, and that a cryolite spray was better than either. A dust containing 0·65 per cent. rotenone gave effective control in some tests, and one of 10 per cent. barium fluosilicate was effective in one series but not in another. Cryolite was less effective in dusts than as a spray, and a spray of fixed nicotine was of no value. In 1941, when infestation was light, a spray of 1 per cent. cryolite, applied against *Clysiana* only, was effective, though less so than in the previous years. The existing arrangements for the dissemination of information as to the correct spraying dates, etc., are described and recommendations are made for extending the service. The date of spraying against the first generation is determined by observations on adult flight, but if the flower buds have not separated when emergence is at its maximum it is advisable to postpone spraying until they separate. A second application should be made a week later if necessary. Sprays against the second generation should be applied when the first eggs hatch or 4–5 days after the peak of adult flight. The spray materials recommended against the first generation are lead arsenate (di- or triplumbic) to give a content of 0·15 per cent. As in the spray, 0·5 per cent. aluminium arsenate or 1 per cent. cryolite, to all of which 0·05 per cent. calcium caseinate should be added. If infestation is slight, the lead arsenate may be applied in a fungicidal copper spray, but the other two materials should not. The same sprays are also effective against the second generation, but can be replaced by dusts containing 15 per cent. cryolite or at least 0·65 per cent. rotenone. The technique of spraying is briefly explained.

Le Goupils (P.). **Les méthodes statistiques dans l'expérimentation. Essais sur l'application des méthodes du calcul des probabilités au dépouillement mathématique des résultats d'expérience.**—*Ann. Epiphyt.* (N.S.) **8** fasc. 2 pp. 189–210, 4 figs., 3 refs. Paris, 1942.

The author points out the value of statistical analysis of the results obtained in tests of insecticides and describes the use of Abbott's formula for determining the mortality caused by the treatments [*cf. R.A.E.*, A **13** 331]. He discusses the relative value of determining the dosages that give 50 and 100 per cent. mortality and shows that it is simplest to find the median lethal dosage and the extent to which mortality from other dosages varies from this. Plotting mortality against dosage or the logarithm of the dosage results in a sigmoid curve [*cf.* **22** 66, etc.]; methods of obtaining the curve, including the choice of dosages to be tested, and of interpreting it analytically are given, and the degree of homogenity desirable in the population of test insects for different experiments is discussed.

Schad (C.) & Guignard (P.). **La pyrale des haricots** (*Etiella zinckenella* **Treitschke**) **parasite du soja dans le sud-ouest de la France.**—*Ann. Epiphyt.* (N.S.) **9** fasc. 2 pp. 169–175, 4 figs., 23 refs. Paris, 1943.

In 1942, *Etiella zinckenella*, Treitschke, did considerable damage to late varieties of soy bean at Ondes (Haute-Garonne) and throughout south-western France [*cf. R.A.E.*, A **35** 270]. This Pyralid is common in the centre and south of France, and was known to infest *Phaseolus* beans there [*cf.* **25** 649; **35** 269].

Brief notes are given on its food-plants and distribution and on the percentages of seeds of different varieties of soy bean infested by it, which varied greatly. In a late variety, the percentages were 10, 16 and 22 for plants sown on 3rd and 15th April and 2nd May, respectively, and in a medium-early one, only those sown on the last date were attacked, the percentage of seeds damaged being 2·6.

There are 2–3 generations in the year in different regions. In temperate ones there are usually two flights, one in May June and another in July–August, and it is probably the larvae of the second generation that attack soy bean in south-western France, the first developing on other leguminous plants.

Usually several eggs are deposited on one pod of soy bean, but only 1–3 larvae penetrate it. In 1942, the larvae mined in the beans for about three weeks and when fully grown left the pods and hibernated in cocoons in the ground or in spaces between the beans if these were already in store ; they entered hibernation between the end of September and early November. They pupated in the following spring and gave rise to adults about six weeks later. A few larvae pupated in the autumn, but the pupae were killed by the winter cold.

Investigations in various countries have shown no very effective control by insecticides or by parasites, a list of which is given, but it is suggested that growing soy beans some distance from other leguminous crops that might serve as food-plants for the first generation, planting them early (from the beginning of April in south-western France), growing resistant varieties and using only uninfested seed and sacks will protect the plants from attack.

Nepveu (P.). **Remarques sur les dégâts du pou de San José.**—*Ann. Epiphyt.* (N.S.) **9** fasc. 2 pp. 235–251, 15 figs. Paris, 1943.

The author describes methods of estimating the injury caused to peach in the Siagne Valley (Alpes-Maritimes) by the San José scale [*Quadraspidiotus perniciosus*, Comst.] based on a comparison of trees on which the scale was controlled by spraying with untreated ones, and concludes from the results obtained that in the Mediterranean region, infestation of peach by *Q. perniciosus* causes a decrease in the length of the branches and in the total leaf area and a corresponding reduction in the ratio of leaf surface to bark surface. If this ratio drops to about a fifth of its normal value in the course of the year, the tree dies.

Simon (L.). **L'hoplocampe du poirier en Anjou en 1943** (*Hoplocampa brevis* **Klug**).—*Ann. Epiphyt.* (N.S.) **10** pp. 79–83, 1 fig., 3 refs. Paris, 1944.

For many years, *Hoplocampa brevis*, Klug, has attacked young pear fruits about a month after blossoming time in Anjou, but damage was slight and localised, and it was considered that removing the infested fruits give adequate control. In 1939, however, some orchards were heavily attacked, and experiments with sprays, the results of which have not been published, were carried out in 1941 and 1942. In 1943, the adults appeared about 20th–25th March, when some varieties of pears were in full bloom, and fed on the nectar. They did not fly much except on hot windless days. In the cages, oviposition began on 29th March ; the eggs were inserted into slits inside the calyx, 2–4 in a flower, and the larvae mined in the developing fruits.

In tests on trees 25–30 years old that began flowering on 25th March and were infull bloom on 5th April, two lead-arsenate pastes were used with a wetting agent at dilutions that gave 92 and 76 gm. arsenic (As) per hectolitre, respectively, in an alkaline Bordeaux mixture. The mean percentages of pears on the trees infested on 29th April were reduced from 73·5 on the controls, to 12·6 and 23·2 by one application of the stronger and weaker spray, respectively, on

5th April, and to 4·3 by two applications of the stronger spray, on 31st March and 5th April. It appeared that the sprays are effective against the adults and to some extent against the young larvae, but not against the full-grown larvae leaving the fruit. The applications made when the trees were in full bloom were injurious to bees, but no influence on pollination was observed. Since the flight and oviposition of the sawfly do not correspond exactly with the stage of development of the trees, it is considered that trapping might be useful in showing the best times to spray.

LUCCHESE (E.). **Contributi alla conoscenza dei lepidotteri del melo.** [Some Contributions to the Knowledge of the Lepidopterous Pests of Apple.] **III.** *Acroclita naevana* **Hb.**—*Boll. R. Lab. Ent. agr. Portici* **5** pp. 1–60, 56 figs., 12 refs. Portici, 1941. **IV.** *Swammerdamia pyrella* **Vill.**—*T.c.* pp. 157–174, 13 figs., 8 refs. 1942. **V.** *Blastodacna putripennella* **Zell.**—*T.c.* pp. 175–195, 16 figs., 5 refs. 1942.

In these three papers, which form part of a series [*cf. R.A.E.*, A **27** 629], the author describes all stages of the moths dealt with and reviews their geographical distribution and the food-plants of the larvae. In observations in 1937–40, *Rhopobota* (*Acroclita*) *naevana*, Hb., was present on apple in nurseries throughout Campania, particularly in coastal districts, was rare on plum, apricot and pear and did not attack any other fruit trees. Larvae on pear did not complete their development, and it is considered probable that a variety has developed preferring apple.

Adults of the generation from overwintered eggs emerged in May, and there appeared to be five overlapping generations a year in the coastal districts. The eggs were laid singly or in groups of 2–3 on the surface of leaves or twigs; they were often found at some distance from the tip of the shoot, but this may have been due to the shoot developing during the egg stage, which lasted six days at 21°C. [69·8°F.] and four days at 23°C. [73·4°F.] and 75–80 per cent. relative humidity. Eggs destined to overwinter were laid on the branches or main stem of the plant, often very close to the ground. The newly hatched larvae crawled to the tips of the shoots and penetrated the folded leaves, mining through the epidermis and the parenchyma and spinning the leaves together with threads. If the larva was unable to reach the shoot, it attached itself to the lower side of a leaf. The young shoots continued to develop and the larvae to bind them with stronger webs. The larvae often attacked the leaf petioles and sometimes also the shoots themselves, causing the loss of the terminal buds, and in a heavy infestation damaging the lateral buds. Occasionally they mined in the fruits. The larval stage was completed in 18 days in June, and a week longer in April. Pupation occurred in cocoons in the shoots, in dead leaves, or in the soil, and the adults emerged after 8–9 days in summer and about 18 days in spring.

Damage to full-grown trees is not serious, but young plants sometimes become deformed through the loss of the terminal buds. The control measures recommended are dipping infested shoots in nicotine sulphate, 0·5 per cent. lead arsenate, or a mixture of both, with the addition of 1lb. soft soap per 10 gals. water, and spraying the overwintering eggs with mineral-oil emulsion or nicotine sulphate. It is considered advisable to cut off infested shoots and retain them in breeding cages to permit the emergence of parasites.

The most important of the natural enemies observed was the Eulophid ectoparasite, *Colpoclypeus silvestrii*, gen. et sp. n., all stages of which are described. The female pierces the web covering a larva of *R. naevana* and lays 6–16 eggs upon it or in the web. The larvae hatched in up to two days in July, fed externally for 5–6 days on the host, and pupated, the prepupal and pupal stages lasting one and five days, respectively. There were several generations between mid-April and late October, each lasting an average of 15–20 days. Females in

captivity laid about 60 eggs each. Larvae of *C. silvestrii* were themselves parasitised by a Eulophid of the genus *Pleurotropis*.

Larvae of *R. naevana* were also parasitised by the Tachinid, *Nemorilla floralis*, Fall., and *Elasmus* sp. The eggs of *Nemorilla* were laid singly on the host, and the larvae fed internally and pupated within the dead host pupa, development from egg to adult lasting 18 days in September 1939 and 12 in May–July 1940 ; each female laid about 40 eggs. The rate of parasitism rose to about 8–12 per cent. during the summer. *Elasmus* was not common and was itself parasitised by *Pleurotropis* sp. ; each generation lasted about a fortnight in summer. The eggs of *R. naevana* were parasitised by *Trichogramma* sp., the larvae of which hibernated in the host eggs and gave rise to adults in April–May. Insects that were predacious on larvae of *R. naevana* comprised larvae of *Chrysopa carnea*, Steph., and of the Syrphid, *Xanthandrus comtus*, Harr. The eggs of *Chrysopa* were laid on infested twigs and the egg, larval and pupal stages occupied 5–6, 12–15 and 10–12 days, respectively, in August. *X. comtus* developed from egg to adult in a little over a month and larvae collected in the field were found to be parasitised by the Encyrtid, *Syrphophagus* (*Microterys*) *aeruginosus*, Dalm. Descriptions are given of all stages of *C. carnea*, *X. comtus* and *N. floralis*, and of the adults of *Elasmus* sp.

The observations on *Swammerdamia pyrella*, Vill., recorded in the second paper, were carried out in the provinces of Avellino in 1940 and Salerno in 1941–42. The adults emerged from the overwintered pupae in late March and April, when apple trees were coming into leaf. The eggs were laid on the leaves about two days after emergence, and the larvae hatched in 9–14 days and mined the leaves during their first instar, after which they fed beneath a web on the lower surface. The larval stage lasted about 20 days in June. Pupation took place in a cocoon spun on a leaf, and the pupal stage lasted 8–15 days, except in the overwintering generation. Four generations were reared in the laboratory in May–October 1941. The damage is not serious, except in very heavy infestations and sufficient control is usually exercised by natural enemies. Those observed comprised *C. carnea* and *X. comtus*, which were predacious on the larvae, *Apanteles* sp., which parasitised up to 80 per cent. of the larvae, and *Trichogramma* sp., which parasitised the eggs

The third paper, on *Chrysoclista* (*Blastodacna*) *putripennella*, Zell., is based on observations in Campania in 1935–40 and Salerno in 1941–42. It is a pest of apple and occasionally attacks pear. The adults emerged from mid-May to the end of June, and the eggs were laid singly on leaves or shoots ; the maximum for one individual was 60–80. The larvae hatched in 11–13 days in May-June and mined in the twigs, usually entering near a bud ; sometimes more than one gallery was formed. They remained in these galleries until the following spring, when they left them and re-entered at the base of another bud. The full-fed larva pupated inside the bud if this was killed, or at the base of a gallery in the shoot if the bud developed. The adults emerged after 16 days in May and 10–12 days in June. In addition to the direct injury caused by the larvae, the wounds they make offer favourable conditions for fungi and *Eriosoma lanigerum*, Hsm. The parasites observed comprised a polyembryonic species of *Copidosoma*, which parasitised 70 per cent. of the larvae, *Eulophus* sp., *Elasmus* sp., and two Ichneumonids. The only control method recommended is the removal during May and June of infested twigs, from which parasites may be reared.

SILVESTRI (F.). **Contribuzioni alla conoscenza degli insetti dannosi e dei loro simbionti. VI. La falena brumale o la brumale** (*Operophthera brumata* **L.).** [Contributions to the Knowledge of harmful Insects and their Symbionts. VI. *Operophtera brumata*.]—*Boll. R. Lab. Ent. agr. Portici* **5** pp. 61–120, 1 fldg. pl., 49 figs., 41 refs. Portici, 1941.

All stages of *Operophtera brumata*, L., are described, and its bionomics in Italy are discussed from observations carried out over many years, with hazel

(*Corylus* [*avellana*]) as the chief food-plant, and compared with those recorded from other European countries. In rearing cages at Portici, over ten or more years, there were no appreciable differences in the dates of emergence of adults from pupae collected in central and southern Italy and in Sicily, at heights ranging from about 300 to nearly 3,000 ft., the majority of both sexes emerging during January. The variations in the life-cycle that occur in different regions of Italy are therefore considered to be due to climatic conditions only, and not to the formation of local races [*cf. R.A.E.*, A **26** 420]. Emergence and pairing usually took place in the early evening, but if the cages were kept dark they occurred at any hour [*cf.* **27** 99]. Oviposition began a few hours after pairing, the eggs being laid singly or in groups of 2–3 or sometimes more on the bark of twigs or branches. It is calculated that females are capable of producing 224 eggs [**33** 119]. Of ten newly emerged adults of each sex kept under observation, males lived for 5–11 days and females for 5–16. The eggs hatched at Portici in an average of 55 days. In southern Italy, most of them hatched during the first half of March at low altitudes and during the first half of April at about 2,500 feet, and the larval stage was completed by mid-April and the end of May, respectively. On hazel, the larvae preferred shoots already damaged by *Phytoptus* (*Eriophyes*) *avellanae*, Nal., but also attacked healthy shoots and leaves. The full-grown larvae descended from the trees and buried themselves in the soil at the foot of the tree at depths of 2–8 ins., forming silken cocoons in which they pupated after 5–8 days.

Hazel trees were sometimes completely defoliated over extensive areas, and damage is also caused to various fruit trees. The control measures suggested include the use of adhesive bands, spraying with a tar distillate to kill the eggs or with 0·5 per cent. lead arsenate against the larvae [*cf.* **31** 140], and digging up the cocoons.

The natural enemies of *O. brumata* are reviewed from the literature. The author has observed larvae attacked by a fungus of the genus *Botrytis* and by Nematodes of the genus *Mermis*, while occasional examples were destroyed by lizards and birds. Insect parasites observed in southern Italy were the Eulophid, *Comedo larvarum*, L., the Ichneumonid, *Pimpla turionellae*, L., and the Tachinid, *Phorocera caesifrons*, Macq., all stages of which are fully described and the alternative hosts listed from the literature, the Tachinid, *Neopales* (*Pales*) *pavida*, Mg., and the Ichneumonid, *Aptesis* (*Microcryptus*) *brumatae*, sp. n. *A. brumatae*, of which the adults, larva and egg are described, was found in the provinces of Naples and Avellino. Adults emerged from the soil at Portici from late March to the end of April, just before the larvae of *Operophtera* entered the ground, and paired immediately. The females, which outnumbered the males, sought out the larvae of *Operophtera* in the ground and laid their eggs singly in the cocoons. At 17–19°C. [62·6–66·2°F.], the larvae hatched in three days and fed for 6–9 days, after which they spun their cocoons inside those of the host ; overwintering pupae were formed after about a month. The percentage of parasitism varied from year to year, but sometimes exceeded 50.

A female of *Comedo larvarum* was observed on hazel at the beginning of April in Avellino ; it laid four eggs on a larva of *O. brumata*. The parasite larvae hatched in seven days, and left the moribund host after about six days. A few days later they pupated on a leaf, and the adults emerged after about six days. The females of *Pimpla turionellae* laid their eggs singly in the pupae of *Operophtera*. The larvae hatched in 3–4 days and pupated after ten days inside the host cocoon. Adults emerged 5–6 days later. The adults of *Phorocera caesifrons* emerged mostly in March and April. Females usually laid their eggs singly on last-instar larvae of *Operophtera*, but sometimes several eggs were found on one larva. In the laboratory at 17–18°C. [62·6–64·4°F.] they hatched in five days. Host larvae bearing eggs entered the soil and formed cocoons ; the parasite larvae developed in the host larvae or pupae and left the host cocoon to pupate. Pupae were found from the beginning of May.

Formica cinerea, Mayr, was predacious on the larvae, and larvae of *Athous* sp. on the pupae. In central Italy, *O. brumata* was parasitised by the Tachinid, *Blepharomyia amplicornis*, Zett.

La Ferla (A.). **Contributo alla conoscenza del balanino delle nocciòle** (*Balaninus nucum* **L.**). [A Contribution to the Knowledge of *Curculio nucum*.]—*Boll. R. Lab. Ent. agr. Portici* **5** pp. 121-156, 19 figs., 22 refs. Portici, 1941.

Hazel (*Corylus avellana*) in the province of Avellino, in southern Italy, is attacked by *Curculio* (*Balaninus*) *nucum*, L., of which all stages are described and the geographical distribution and alternative food-plants reviewed from the literature. Observations on the bionomics of this weevil were made in 1940–41 in the field in Avellino and in the gardens of the laboratory at Portici. In the field, adults were already present on the trees in March 1940, and persisted in numbers until mid-July. During April and May they were also found on cherry trees near hazel, and did a certain amount of damage to the young fruits. On hazel, they were observed to feed on the nuts and, in captivity, on the leaves, particularly the main veins, but not on the buds. Pairing took place between mid-June and late July, and oviposition began towards the end of June, when early varieties of hazel were beginning to fruit. The eggs were laid in the nuts through holes bored in the shell, usually only one per nut. Oviposition on late hazel began in mid-July and was generally less intense. The larvae hatched in 6–10 days, entered the nuts and fed on the kernels. After about a month, they left the nuts, which by this time had usually fallen to the ground, buried themselves in the soil at depths of 1-4 ins. and formed cells in which they overwintered. It was not known when they pupated, and mature larvae were still present in the soil in 1940 right up to the time when those of the new generation were leaving the nuts. It is concluded that the life-cycle of *C. nucum* lasts more than a year [*cf. R.A.E.*, A **33** 382].

The author does not consider that the feeding punctures of the adults injure the developing nuts to any extent; the larvae, however, cause losses of 6–15 per cent. of the crop, and even 30 per cent. on early varieties. The control measure recommended is the collection of fallen nuts and the destruction of the larvae that emerge from them [*cf.* **28** 166]. If sufficient labour is available, the adults may be jarred from the trees in May and June [**19** 250]. A few overwintering larvae were found attacked by fungi, but no other parasite of any stage was observed.

Lupo (V.). **Il *Mytilococcus ficifoliae* (Berlese) è una forma estiva del *M. conchiformis* (Gmelin).** [*Lepidosaphes* (*M.*) *ficifoliae* is a summer Form of *L.* (*M.*) *ficus*, Sign. (*conchiformis*, auct.).]—*Boll. R. Lab. Ent. agr. Portici* **5** pp. 196–205, 8 figs., 18 refs. Portici, 1943.

Lepidosaphes (*Mytilococcus*) *ficifoliae*, Berl., which infests the leaves of fig, has usually been distinguished from *L. ficus*, Sign. (*M. conchiformis*, auct.), which occurs on the branches, by the constrictions on the scale of the female, which are absent in *L. ficus*. Working in Italy, the author observed that these constrictions in the scales corresponded exactly in position to the hairs on the leaves by which they were surrounded, and concluded that they were due to lateral pressure. It is not known what becomes of the leaf form in winter, but examples found in winter on the branches of trees that had borne heavily infested leaves in summer were all apparently *L. ficus*. When eggs of the latter were placed in a glass tube over a fig leaf, some of the resulting crawlers attached themselves to the leaf; they gave rise to adults after 45–50 days, and these had all the morphological characters of *L. ficifoliae*. Similar results were obtained when branches heavily infested with *L. ficus* were placed in contact with the trunk of a small uninfested fig tree; two months later the leaves bore numerous scales having the characters of *L. ficifoliae*.

In subsequent tests, four uninfested fig trees were kept in a greenhouse. In September, leaves infested by *L. ficifoliae* were attached to two of these, and the others kept as controls. In the following April the branches of the former were found to be covered with Coccids identified by microscopic examination as *L. ficus*. It is thought therefore that some of the crawlers that hatch in summer from eggs of *L. ficus* pass to the leaves and acquire different characters from those that remain on the branches. Ferris distinguishes *L. ficifoliae* by the heavy chitinisation of the last two abdominal segments preceding the pygidium, but examples showing this character did not occur among the author's specimens.

LUCCHESE (E.). **Contributo alla conoscenza della** *Rhaphidopalpa foveicollis* **Lucas (Coleoptera-Chrysomelidae).** [A Contribution to the Knowledge of *Aulacophora foveicollis*.]—*Boll. R. Lab. Ent. agr. Portici* **5** pp. 274–295, 12 figs., 15 refs. Portici, 1945.

All stages of *Aulacophora* (*Rhaphidopalpa*) *foveicollis*, Lucas, are described and its geographical distribution and food-plants are reviewed from the literature. Observations in Salerno during 1942 showed that the overwintered adults resumed activity in April, attacking young melon plants as soon as the first shoots appeared and, in a heavy infestation, destroying them completely; the leaves of larger plants are perforated. The adults became rarer towards the end of June, but those of the new generation were already emerging, so that there was little interruption of infestation. Oviposition began towards the end of May, the eggs being laid in the soil at the foot of the plants. Females laid more than 300 eggs each, and there was possibly more than one generation during the year, as oviposition was observed as late as 21st July. The eggs hatched in 14–16 days in May–June and in 8–10 in late July. The young larvae attacked the roots of the plants, and also fruits that were in contact with the soil, facilitating the entry of fungi and bacteria. The larval and pupal stages lasted 30–40 and 8–10 days. The adults fed on the leaves and flowers of late varieties of melon until September and hibernated in long grass, fallen leaves and crevices.

Control measures are briefly discussed from the literature. In 1941–42, sprays of 1 per cent. lead arsenate or calcium arsenate were effective against the adults, one application as soon as activity began being followed by another a fortnight later. A 1 per cent. calcium arsenate dust also gave good results when used by growers in 1942.

SILVESTRI (F.). **Descrizione e biologia del coleottero stafilinide** *Belonuchus formosus* **Grav. introdotto in Italia per la lotta contro ditteri tripaneidi.** [Description and Biology of the Staphylinid, *B. rufipennis*, F., introduced into Italy against Trypetid Flies.]—*Boll. R. Lab. Ent. agr. Portici* **5** pp. 312–326, 13 figs. Portici, 1945.

In November 1937, examples of the Staphylinid, *Belonuchus rufipennis*, F. (*formosus*, Grav.), were brought by the author to Italy from São Paulo, Brazil, where the adults and larvae are predacious on the larvae of fruit-flies [*cf. R.A.E.*, A **35** 106]. It was reared in zinc cages of various sizes, at first on larvae of *Dacus oleae*, Gmel., in olives, *Rhagoletis cerasi*, L., in cherries or *Ceratitis capitata*, Wied., in bitter oranges and then in 1940–42, when *Ceratitis* was scarce, on larvae of *Drosophila* sp. in a succession of fruits. Between 1939 and 1941, colonies of 48–1,540 individuals were released, two in Campania, seven in Calabria and six in Sicily, for the biological control of *Dacus* and *Ceratitis*, but it was not known whether they became established. Descriptions are given of all stages of *B. rufipennis* and of the adults of *B. mexicanus*, Solsky, and *B. decipiens*, Sharp, which are also predacious on fruit-fly larvae in São Paulo.

KNECHTEL (W.). **Crop Pests observed in Rumania.**—*Int. Bull. Plant Prot.* **18** no. 5–6 pp. 37M–39M. Rome, 1944.

Macrosiphum (*Acyrthosiphon*) *onobrychis*, Boy., was unusually injurious to pea and vetch crops in Rumania in 1942, and *Pyrausta nubilalis*, Hb., attacked hemp in the Danube valley, in areas in which there was less maize than usual. *Thrips lini*, Lad., was observed for the first time on flax, a crop of increasing importance, in the vicinity of Bucharest, but did not cause appreciable damage. *Hercinothrips* (*Heliothrips*) *femoralis*, Reut., was found in greenhouses, first on *Cineraria* that was also infested by *Macrosiphum koehleri*, Börner, *Myzus ornatus*, Laing, and *M.* (*Myzodes*) *persicae*, Sulz., and later on azaleas. *Taeniothrips dianthi*, Priesner, and *Thrips tabaci*, Lind., caused dwarfing and malformation of carnations, the former doing severe damage. *Nematus* (*Pteronus*) *ribesii*, Scop., destroyed the leaves of red currants in Transylvania and consequently reduced their yield, and the mite, *Tetranychus telarius*, L. (*althaeae*, v. Hanst.), developed in large numbers in the wine-growing region of Odobeşti and caused considerable damage to vines of some varieties. It was found that the excessively long and severe winter of 1941–42 had almost completely destroyed *Quadraspidiotus* (*Aonidiella*) *perniciosus*, Comst., in the nurseries infested by it.

SILVESTRI (F.). **Contribution to the Biology of the Olive Gall Gnat** (*Prolasioptera berlesiana* **Paoli**) **in Italy.**—*Int. Bull. Plant Prot.* **19** no. 9–10 pp. 73M–76M, 1 fig. Rome, 1945.

Adults of *Lasioptera* (*Prolasioptera*) *berlesiana*, Paoli, are present in olive groves in Italy at the end of June or beginning of July when oviposition by *Dacus oleae*, Gmel., begins, and deposit one, occasionally two and rarely three eggs in the oviposition punctures, of the latter [*cf. R.A.E.*, A **34** 326]. The larvae hatch in about 24 hours and suck out the contents of the *Dacus* eggs in 4–5 days. They become fully grown in 8–10 days and leave the fruit by the same tunnel to pupate in the ground; the adults emerged within 7–9 days and lived only a few days when kept in closed tubes containing honey. The newly shrivelled *Dacus* eggs are covered with a mycelial growth of *Macrophoma* (*Phoma*) *dalmatica*, but sound ones are not, indicating that the fungus is introduced by *L. berlesiana* [*loc. cit.*]. The fungus grows in the fruit together with the *Lasioptera* larvae, and eventually causes the fruit to drop. The Cecidomyiid appears to produce several generations in the year; it was found in olive groves in decreasing numbers from early July until October and probably lives on wild plants from autumn until spring. Figures are given showing that the percentages of olives infested by *Dacus* and by *Lasioptera* vary from district to district and from year to year but are sometimes very high. The Cecidomyiid is present throughout Italy, in Cyprus and probably in all other Mediterranean regions, but no definite data are available as it has apparently been confused with *Asynapta furcifer*, Barnes, which is common in Sicily, Corfu and probably elsewhere. In Italy, *L. berlesiana* was numerous in the Foggia region, near Cassino and at Pisciotta; it was attacked by a Eulophid of the genus *Tetrastichus*, and an undetermined Proctotrupid.

JANNONE (G.). **First Observations on a Mite Parasite of the Papaw and on a Predator of same, in Eritrea.**—*Int. Bull. Plant Prot.* **19** no. 11–12 pp. 90M–92M. Rome, 1945.

The author reports extensive and severe infestation of papaya by a mite, tentatively identified as the species called *Anychus latus*, C. & F., by Sayed

[*cf. R.A.E.*, A **31** 441], on the western slopes of the mountains of Eritrea, where it was observed on various dates from December 1939 to July 1945. It seems to require a fairly high temperature and considerable atmospheric moisture and to be present throughout the western slopes at altitudes of about 1,700 to 5,250 ft. It attacks the leaves, stems, flowers and green parts of the trunk of both male and female trees, and the aerial parts of cotton, castor, beans and wild herbaceous plants. Injured papaya fruits have characteristic drops of solidified latex on the surface. The large numbers of mites that congregate on the leaves cause shedding of flowers and small fruits in the dry season, from October to about April.

Most of the eggs are attached to the under surface of the leaves, but some occur on the upper leaf surface and other parts of the plant. There are several generations in the year, but reproduction diminishes perceptibly during the rainy season, possibly because of the lower temperature. The mites are carried from plant to plant and to other plantations by the wind or on animals or man. The larvae and adults of a Coccinellid, probably *Scymnus morelleti*, Muls., feed on all stages of the mite, but do not give commercial control.

Tests in the hot dry season of 1944–45 showed that effective control can be obtained with sprays of 1 per cent. kerosene emulsion or nicotine and soap, but at least three thorough applications over a period of 3–4 months to papaya and other infested plants in the vicinity were necessary. The results of control were visible at once on the female papaya plants, which started to flower normally within a few days and set all their fruit.

ROBERTI (D.). **A serious Attack of Red Spider** (*Tetranychus telarius*) **on** *Citrus* **along the Sorrento Coast.**—*Int. Bull. Plant Prot.* **20** no. 3–4 pp. 26M–28M, 1 ref. Rome, 1946.

Tetranychus telarius, L., attacked *Citrus* on the Sorrento coast of Italy very heavily in July 1944, causing particular damage to lemon trees. It becomes numerous nearly every summer and does appreciable damage to tomato, egg-plant [*Solanum melongena*] and beans, but had not previously been so injurious to lemons in this district, where they constitute one of the chief basic crops. It is possible that its rapid development was due to the heavy fall of volcanic dust that followed the eruption of Vesuvius in the previous March though the effect of the dust is not known, and it is certain that the particularly dry season favoured the increase of the infestations and prolonged their duration. The mite formed extensive colonies on the lower surface of the leaves, causing them to wrinkle, turn yellow and fall, and also attacked many of the fruits over all their surface, causing discoloration, cessation of growth and some fruit drop. Total defoliation occurred in many groves. Orange trees were attacked only on the leaves and less severely than lemon, as the foliage did not drop. Other infested plants included pumpkin, tomato, potato, egg-plant [*Solanum melongena*], beans and less seriously cabbage ; fig and peach were attacked in some places, but grape-vine and walnut were free from injury. The mite increased rapidly until the early rains and lower temperatures in August, when it decreased considerably ; it disappeared from *Citrus* by the beginning of September. It was attacked on *Citrus* by predacious Thysanoptera, Coleoptera, Neuroptera and Diptera, but they did not give commercial control. The most active was a Coccinellid of the genus *Stethorus*, larvae and adults of which destroyed all stages.

A lime-sulphur spray applied twice with an interval of 10–12 days gave more effective control than sulphur dust. Washing the plants with a strong jet of water was said to give some control. Other infested plants were either sprayed or dug into the soil.

Colorado Beetle (*Leptinotarsa decemlineata* Say) **Infestation in Piedmont, Italy.**—*Int. Bull. Plant Prot.* **19** no. 11–12 pp. 89M–90M. Rome, 1945.

DELLA BEFFA (G.). **Colorado Beetle Infestation in Piedmont, Italy in 1945.**—*Op. cit.* **20** no. 9–10 pp. 82M–83M. 1946.

In the first of these papers it is reported that *Leptinotarsa decemlineata*, Say, was found in Turin Province in 1944 and 1945 and in smaller foci in other provinces of Piedmont in the latter year, having probably been introduced by German troops in potatoes from the Arc Valley in the autumn of 1943. Control by hand collection and repeated spraying and dusting with arsenicals was begun in 1944 and was followed by winter treatment of the soil with carbon bisulphide, but the infestation in Turin Province in 1945 was more extensive than in the preceding year.

In the second paper it is recorded that in Turin the adults began to emerge in the middle of April and were particularly numerous during the first fortnight of May. Larvae of the first generation were present from the end of May to the end of June, adults in July, and larvae and adults of the second generation to the end of August and in September, respectively. Some larvae of a third generation hatched, but did not complete their development. Although a large part of the province of Turin was infested in 1945, no appreciable damage was done to the potato crop, as arsenical sprays and dusts were applied in time; lead arsenate gave the best results. Egg-plants [*Solanum melongena*] were severely attacked, particularly towards the end of August and in September, as potatoes are lifted in the middle of August in Turin. Tomatos were attacked very little and peppers [*Capsicum*] hardly at all.

A list is given of the communes in which foci were found at the end of 1945; they comprise 32 in Turin Province and nine in four other provinces.

The Appearance and Advance of the Colorado Beetle (*Leptinotarsa decemlineata*) **in Switzerland and in Liechtenstein in 1945.**—*Int. Bull. Plant Prot.* **20** no. 5–6 pp. 38M–40M. Rome, 1946. **The Colorado Beetle in French Switzerland.**—*T.c.* nos. 7–10 pp. 69M–70M, 83M–85M.

In the first of these papers it is reported that *Leptinotarsa decemlineata*, Say, spread over almost the whole of Switzerland and Liechtenstein in 1945. Infestation of potato was very severe in some parts, but decreased in intensity from west to east. The adults were first observed in the middle of March and were present in all districts in May. The main invasion took place in the first half of June in the low-lying localities of the west and north-west and in the second half of June and early July in the centre and east. Adults of the summer generation appeared in July, but their numbers declined steadily towards the end of July and in August, apparently because the hot dry weather caused them to enter the soil earlier than usual. Many were brought to the surface during potato harvesting and ploughing in the autumn, indicating that they were hibernating in large numbers.

In the second paper it is recorded that conditions for hibernation were extremely favourable in French Switzerland in the winter of 1945–46, and that a very early spring caused an early emergence of overwintered adults in March, before the newly planted potatoes had sprouted. Oviposition had begun by early May, but relatively low night temperatures in that month reduced the rate of development, and heavy rains and the absence of strong winds in June prevented the spread of the beetle. Wide variations in temperature in June made hatching very irregular and the timing of sprays difficult, and reduced the emergence of the summer generation in July. There was little oviposition on early potatoes in dry hot districts and the number of adults diminished rapidly, but eggs were laid throughout July on late potatoes, and the hatching of the larvae made treatment during the first fortnight of August necessary

to reduce the number of overwintering insects and prevent severe attack in 1947. Egg-plants [*Solanum melongena*] were severely damaged in July in the canton of Geneva.

Rainy weather in August and September hindered the emergence of the adults, oviposition and hatching, and oviposition stopped early owing to the rapid drying up of many potato fields due to a severe attack of mildew (*Phytophthora infestans*). In the high-lying regions, frost at the end of August caused the beetles to disappear. In the plains, practically no larvae were found at the end of September, but there were some adults, mainly on late potatoes. Moreover it was reported at the end of August that adults were attacking the epidermis of tubers with withered haulms, and it is thought that beetles derived mainly from the summer generation are found in certain regions of the plain before the hibernation period.

PUSSARD (R.). **Documents pour la lutte contre la teigne de la pomme de terre.** —*C. R. Acad. Agric. Fr.* **30** no. 4 pp. 96–97, 1 ref. Paris, 1944.

The results are given of experiments in France on treatments of stored potato tubers against *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell. Carbon bisulphide was used in a fumigation chamber, which is described and in which the maximum concentration that could be obtained in practice was about two-thirds of the theoretical one. It was found that exposure for 15 hours at 15–25°C. [59–77°F.] to commercial carbon bisulphide applied at a rate of 0·6 oz. per 10 cu. ft., based on the volume of the empty container, destroyed all the immature stages and did not interfere with the sprouting or keeping properties of the tubers. In the case of the two varieties tested, this quantity of fumigant corresponded to a theoretical concentration of about 1·5 oz. carbon bisulphide per 10 cu. ft. space unoccupied by tubers. Most of the gas retained by the tubers after the treatment was released on exposure to the air for three days; since the tubers are not consumed until they have been cooked, the retention of a small quantity of carbon bisulphide is immaterial. Females of *Gnorimoschema* oviposited less readily on treated tubers during the week after fumigation than on untreated ones. The flavour of the treated tubers was not impaired, but they sprouted more quickly than the controls under favourable temperature conditions.

Dusts were tested by exposing tubers coated with them to ovipositing females in dark cages. Complete protection was given by rotenone dusts, neutral ortho-oxyquinoline sulphate, and mixtures containing at least 50 per cent. pyrethrum powder or at least 20 per cent. barium fluosilicate or sodium fluosilicate in talc; the fluosilicates should be used only on seed potatoes. Silica dusts were ineffective and treatment with sulphuric acid to prevent sprouting in tubers for consumption did not hinder the development of *Gnorimoschema*. Adults were not able to pass through metal gauze with a mesh of 0·99 mm. Experiments showed that the larvae can complete their development in tubers of *Solanum demissum* and in leaves of *Physalis viscosa*.

SUIRE (J.). **Sur la biologie d'un ampelophage occasionnel, *Epidola stigma* Stgr. (Lep. Gelechiidae).**—*C. R. Acad. Agric. Fr.* **30** no. 11 pp. 286–287, 4 refs. Paris, 1944.

An outbreak of *Epidola stigma*, Stgr., occurred in a vineyard in the south of France at the beginning of the summer of 1942, when one-year-old plants were almost completely defoliated in a fortnight. This Tineid generally feeds on low-growing plants, and the attack is attributed to the removal of these when the vineyard was planted. The larvae developed normally on grape-vines, but the females did not appear to be attracted to them, and no eggs could be found on them. The habits of the larvae are described.

Suire (J.). **Remarques sur le carpocapse des châtaignes (*Laspeyresia splendana* Hb.) dans le Midi de la France.**—*C. R. Acad. Agric Fr.* **30** no. 11 pp. 288–289, 2 refs. Paris, 1944.

At the beginning of the winter of 1943, chestnuts grown in southern France were found to be infested to an almost equal extent by *Cydia* (*Laspeyresia*) *splendana*, Hb., and *Curculio elephas*, Gylh., and infestation, mostly by *Cydia* was as high as 82 per cent. in nuts from two places in Aveyron. In Hérault, the adults of this Tortricid first appeared at the beginning of July and began to oviposit during the second half of the month. The egg stage was of short duration. The earliest larvae left the nuts at the end of September and the majority in mid-October ; they then formed cocoons in the soil at a depth of not more than about three inches. A few adults emerged in October, but pupation normally takes place in the following spring. In cooler districts, larval development is slower, and larvae found in the Cévennes in the middle of November were not fully grown ; in another district, the larvae did not leave the nuts until 8th December. Since development can take place in acorns and females (of var. *reaumurana*, Heinr.) reared from acorns oviposited on chestnuts, on which their progeny developed normally, a temporary suppression of chestnuts would be of no value as an eradication measure.

Nepveu (P.). **Sur la possibilité de faire, sur pêcher, une fumigation cyanhydrique après application de bouillie bordelaise.**—*C. R. Acad. Agric. Fr.* **30** no. 11 pp. 289–290. Paris, 1944.

Experiments were carried out during the winters of 1941–42 and 1942–43 to determine whether peach trees in the south of France that had been sprayed with Bordeaux mixture could safely be fumigated with hydrocyanic acid gas against *Quadraspidiotus perniciosus*, Comst. The neutral Bordeaux mixture employed contained 2 per cent. copper sulphate, and the sprayed trees were fumigated under tents after intervals ranging from two hours to two weeks. All the treatments were completed before the buds unfolded. Fumigation was performed in the evening at temperatures of 10–15°C. [50–59°F.] and in the absence of dew ; the relative humidity under the tents varied from 0 to 75 per cent. The gas was generated by the pot method, using a mixture of 1 part sodium cyanide, 2·5 parts water and 1 part sulphuric acid, and applied according to the normal schedule. When the tents were removed, the treatment was found to have changed the colour of the spray deposits to bright yellow on trees fumigated 2–12 hours after spraying and to grey on trees fumigated after 1, 6, 10 or 14 days, the shade of grey being progressively darker as the interval between the treatments increased. The yellow deposits destroyed the one-year-old wood and damaged older wood, but the grey ones were less injurious. When the interval between spraying and fumigation was only one day, extensive scorching occurred and most of the buds were destroyed, but the growth of those that remained was extremely vigorous. When it was six days, only the ends of the branches and some buds in the axils on which the deposit was thick were scorched. No harmful effects were noted on trees fumigated ten or 14 days after spraying or on others bearing older deposits that had been exposed to rain, though some of the latter were fumigated at twice the normal concentration. The fumigation apparently did not interfere with the fungicidal action of the Bordeaux mixture.

Viel (G.). **La technique des fumigations cyanhydriques de plein champ.**—*Déf. Cult.* **1** pp. 16–21, 3 figs., 19 refs. [? Paris] 1945.

In view of the efficiency of tent fumigation with hydrocyanic acid gas in controlling Coccids on *Citrus* in the United States and elsewhere, work has been begun on its use against foci of *Quadraspidiotus perniciosus*, Comst., on

deciduous fruit trees in France, and the author therefore describes the chemical, physical and toxicological properties of the compound and its action on insects and gives details of methods of generating and applying it and of the influence of temperature, humidity and other factors on its effectiveness against insects and its injuriousness to trees.

He points out that the most suitable season for fumigation depends on the type of tree, local climatic factors and the stage of development of the insect. Against *Q. perniciosus* on peach, treatments are made at the end of winter, though they have also been effective when made soon after harvest. For the treatment of *Citrus*, the temperature should be between 6 and 21°C. [about 43–70°F.]. The peach trees in the Siagne valley have been fumigated at lower temperatures, but it is preferable not to fumigate at temperatures lower than 0°C. [32°F.], at which the scales are more resistant and the concentrations of gas lower. *Citrus* should not be fumigated by the pot method when it is sunny, but it is not known whether the same applies to fruit trees in a dormant condition ; calcium cyanide can be used in the daytime. Fumigation of peach trees can be carried out a month after treatment with Bordeaux mixture without harming the trees [*cf.* preceding abstract].

VIEL (G.). **Valeur insecticide des huiles végétales dans la lutte contre le pou de San José** (*Quadraspidiotus perniciosus* **Comst.**).—*C. R. Acad. Sci.* **221** pp. 589–590, 4 refs. Paris, 1946.

With a view to replacing mineral oil by vegetable oils in spray emulsions for the control of *Quadraspidiotus perniciosus*, Comst., in France, tests were begun in Alpes-Maritimes in 1942 in which seven vegetable oils were applied to infested peach trees in early spring. The results were estimated 4–5 weeks later, in March, and showed that the only one with an effectiveness at all comparable with that of a refined white mineral oil was ground-nut oil. The mineral oil gave 97·3–99·5 per cent. control at 1·6 per cent. actual oil, and ground-nut oil gave 98·6–99·5 per cent. at 3·75 per cent.

BÉGUÉ (H.) & TARAMARCAZ (J.). **Etude des fabrications françaises d'arséniates de chaux.**—*Ann. agron.* **15** pp. 301–318, 2 refs. Paris, 1945.

In view of the increasing use of calcium arsenate as an insecticide in sprays in France and the consequent need for improving its quality investigations were carried out in 1942 on 23 commercial and crude products made in France, in order to determine the lines along which attempts at improvement should be made.

Biological, physical and chemical tests showed that almost all the materials gave more than 90 per cent. mortality in four days of larvae of *Leptinotarsa decemlineata*, Say, on potato in experimental plots and that most gave 98 per cent. or more, being more effective than lead arsenate and most effective at concentrations of 1·2–1·4 lb. arsenic (As) per 100 gals. spray ; that most of the commercial preparations settle rapidly when suspended in water, though this may be prevented by finer grinding or by using suitable adjuvants ; that the average concentration of trivalent (arsenious) arsenic was 0·99 per cent. of the total arsenic, whereas, although there seems to be no connection between trivalent arsenic content and leaf scorch, 0·5 per cent. is considered the maximum desirable ; that the average content of soluble arsenic, which appears to cause leaf scorch, was 4·9 per cent. of total arsenic (A.O.A.C.), and that 35 per cent. of the products contained more than this and needed improvement.

It is stated in conclusion that the best type of calcium arsenate produced in 1942 contained about 0·03 gm. arsenious arsenic and 0·2 gm. soluble arsenic per 100 gm. total arsenic and gave complete mortality of larvae of *L. decemlineata* in 90 hours and that 48·4 per cent. of it remained in suspension in water for 30 minutes.

Busvine (J. R.) & Barnes (S.). **Observations on Mortality among Insects exposed to dry insecticidal Films.**—*Bull. ent. Res.* **38** pt. 1 pp. 81–90. London, 1947.

A method of impregnating filter papers with solutions calculated to give standard deposits of solute per unit area after the evaporation of the solvent is described, and the results are given of tests of insecticides made by confining Arthropods for various periods on papers so treated with them. The eleven Arthropods used included larvae of *Tenebrio molitor*, L., and adults of *Calandra granaria*, L., and *Tribolium confusum*, Duv. The insecticides were pure p,p′ DDT, pure γ benzene hexachloride [GBH], a pyrethrum concentrate containing 20 per cent. pyrethrins, and crystalline rotenone. With a standard exposure of two hours at 30°C. [86°F.] to freshly prepared films, GBH, pyrethrins, DDT and rotenone were toxic in that order, the deposits necessary to give 50 per cent. kill being estimated as 0·00001–1·0, 0·0006–1·0, 0·0005–10·0 and 2 to more than 10 mg. per sq. cm., respectively, according to species. The larvae of *Tenebrio* were much more resistant than any of the other Arthropods except to DDT, to which *Rhodnius prolixus*, Stål, and *Ornithodoros moubata*, Murr., were equally so. Adults of *Tribolium* and *Calandra* were resistant to DDT and pyrethrins, but the former were susceptible to GBH. Comparison of median lethal doses of GBH, DDT and pyrethrins in these tests with those of the same insecticides applied as sprays in oil solution showed that the relationships are quite different as regards magnitude, and sometimes even order, of toxicity. The very sparse toxic films of GBH soon lost their toxicity, apparently by evaporation. The pyrethrin films were also less persistent than those of DDT, which retained their power for at least three weeks.

Other tests were carried out at room temperature, and in some of them the treated filter paper was further impregnated with 4-chlor-2-methyl-phenol to give a deposit of 0·0025 mg. per sq. cm., the irritant effect of which kept the insects moving frequently without injuring them. Percentage mortality among bugs (*Cimex lectularius*, L.) kept in motion for a specified period over a given deposit of DDT was generally greater than that among stationary bugs exposed to the same deposit for the same period. The addition of an irritant to a DDT spray would therefore enhance its efficiency. For each DDT deposit, the percentage mortality among bugs increased as the time of exposure increased from five to 45 minutes, but the difference in percentage kill among bugs exposed for one hour and 24 hours was negligible. Complete kill was achieved only after exposure for four days to the heaviest deposit (5 mg. per sq. cm.) and seven days to the lighter ones. When stationary bugs were exposed to GBH or moving lice (*Pediculus humanus*, L.) or flour beetles (*Tribolium confusum*) to DDT, percentage mortality increased progressively with the time of exposure. Percentage mortality among bugs exposed intermittently to DDT for a given total period of exposure did not differ appreciably from that obtained among those exposed continuously for the same period.

Cowland (J. W.). **The Cotton Jassid (*Empoasca libyca*, Berg.) in the Anglo-Egyptian Sudan, and Experiments on its Control.**—*Bull. ent. Res.* **38** pt. 1 pp. 99–115, 7 figs., 13 refs. London, 1947.

Empoasca lybica, Berg., has recently become a major pest of cotton in the northern and western blocks of the Gezira Irrigation Scheme; it was first suspected to be of importance in the northern Gezira in 1934–35 [*R.A.E.*, A **25** 217], shortly after that area was irrigated. It had previously been numerous in some years in the Messellemia Group and probably caused damage, and was at that period incorrectly identified as *E. facialis*, Jac. [*cf.* **19** 731]. *E. lybica* occurs in Africa from the Mediterranean to Tanganyika, and is the only

abundant species of its genus in the Sudan north of latitude 10°N. It feeds on numerous plants in the Sudan, a list of which is given, and those on which it has been shown to breed include *Hibiscus esculentus*, potato, tomato, egg-plant [*Solanum melongena*] and beans, in addition to cotton. This Jassid is one of those that feeds by penetrating the phloem and xylem vessels [*cf.* **19** 687–688] and so causes the symptoms known as hopperburn, which are described. In an experiment in 1935, cotton plants that were each infested with 100 nymphs began to show typical hopperburn within a fortnight and later ceased growth and shed the upper bolls and buds ; the average number of bolls that matured on these plants was only 14·8, as compared with 35 on control plants.

The egg and nymphal stages of *E. lybica* last about eight days each and the adults live for as long as two months ; development is retarded during cold, dry conditions. To determine the reproductive potential during the cotton season, cotton plants sown on 12th August, 12th September and 12th October were kept in cages and each was later infested with five pairs of Jassids, which were left on the plants until all the females were dead. The average numbers of nymphs produced ranged from 205 and 295, respectively, on plants sown in August and infested on 28th September and 8th October to 42, 57 and 13 on plants sown in August, September and October, and infested on 8th January.

The Jassids migrate to the cotton seedlings as they appear above the soil in August, increase rapidly until the end of November and then decrease fairly rapidly until, by the end of February, few remain. They are fairly numerous on egg-plant from January onwards and later occur in small numbers on weeds and on plants in gardens and on banks, breeding slowly until August. Collections of adults from cotton in the central and northern Gezira, made by sweeping at fortnightly intervals during the seasons of 1942–45, showed that the amount of hopperburn was correlated with the size of the population and that the Jassids were considerably more numerous in the north. The adults are parasitised by *Stylops* sp. to a fair extent at the Gezira Research Farm (central Gezira), but parasitism in the north is only slight. Jassids were significantly more numerous on cotton that received a nitrogenous fertiliser than on that that did not in most years in the north ; they were also more abundant when the distance between the plants in the rows was 30 cm. than when it was 60.

Details are given of the results of spraying with Bordeaux mixture for the control of the Jassid on experimental plots of cotton in 1944–45. The sprays were applied in October-November, and (except where infestation was very light) a single application considerably increased the yield of seed cotton, while three applications increased it somewhat more. The sprayed plants also showed less hopperburn, produced more fruits and more seed cotton per boll at each picking, and shed rather fewer fruits from the upper part of the plant and rather more from the lower part. It is considered, however, that Bordeaux mixture could not be used on a large scale as it is too difficult to prepare.

Records are given of other Jassids that occur in the Sudan, with notes on their distribution and food-plants in other parts of Africa. They include *Erythroneura lubiae*, China, which is widespread throughout the irrigated area of the Sudan and numerous on American cotton in the Northern Province, but occurs only occasionally on Egyptian cotton in the Gezira. It feeds chiefly on leguminous plants, but is abundant on plants of other families in association with *E. lybica*. Its feeding causes the upper surface of the leaves to become spotted [*cf.* **19** 687]. *Empoasca facialis* is found on rain-grown cotton in Kordofan Province and on cotton and sweet potatoes in Equatoria Province, and *E. distinguenda*, Paoli [**21** 60] was bred on castor [*Ricinus*] at the Gezira Research Farm in January 1946.

Trägårdh (I.). **Final Survey of the Wood-destroying Insects in public Buildings in Sweden.**—*Bull. ent. Res.* **38** pt. 1 pp. 117–122, 1 map, 2 refs. London, 1947.

The survey of wood-destroying insects in buildings in Sweden [*cf. R.A.E.*, A **29** 324, etc.], was concluded by investigations in Norrland (northern Sweden), and the findings are presented in this paper, together with a recapitulation of some of the conclusions previously reached. The percentage of buildings damaged was considerably less in Norrland than farther south, but the same insects were involved, although *Hylotrupes bajulus*, L., and *Anobium punctatum*, Deg. (*striatum*, Ol.) were both rare and the former was recorded only from the most southerly part of the area. Infestation by *Ernobius mollis*, L., was rather less and that by *Callidium violaceum*, L., considerably more common than in Svealand [*cf.* **29** 324]. Heavy coastal infestation occurred only in the extreme south, possibly owing to the absence farther north of *H. bajulus* and *A. punctatum*. The roof-timbers were again the part of the buildings most frequently attacked, evidently because the bark is not removed from them and provides suitable shelter for *C. violaceum* and *E. mollis*; the supply of suitable sites becomes exhausted in houses exceeding 30 years of age and attack in them is less frequent.

Lever (R. J. A. W.). **Insect Pests of some economic Crops in Fiji. No. 2.**—*Bull. ent. Res.* **38** pt. 1 pp. 137–143. London, 1947.

This supplementary list of insects that attack cultivated plants, stored products and miscellaneous materials in Fiji is similar in arrangement to the original one [*cf. R.A.E.*, A **33** 136]; it includes additional crops as well as further pests that attack some of the crops already dealt with. Corrections to the previous list are appended.

Simmonds (F. J.). **The Biology of the Parasites of** *Loxostege sticticalis*, **L., in North America**—*Bracon vulgaris* (**Cress.**) (**Braconidae, Agathinae**).—*Bull. ent. Res.* **38** pt. 1 pp. 145–155, 8 figs., 11 refs. London, 1947.

The author gives an account of studies in Canada on the bionomics of *Cremnops* (*Bracon*) *vulgaris*, Cress., a common parasite of the sugar-beet webworm, *Loxostege sticticalis*, L., there and in the United States that is being introduced into South Africa for trial against *L. frustalis*, Zell., together with a note on its taxonomy and descriptions of all stages. The range of this Braconid appears to coincide with that of *L. sticticalis* throughout the Great Plains and Rocky Mountains, and it has been recorded from *L. commixtalis*, Wlk., in Colorado [*R.A.E.*, A **21** 421]; in these studies it was reared from *L. sticticalis* collected in Montana and Alberta. The percentage parasitism among hibernating larvae was 6·4 in 1941, 8 in 1942 and 5·5–8·4 in 1945, but parasitism as high as 98 per cent. was recorded in Montana in a paper already noticed [**30** 462]. The parasite overwinters in the first larval instar within the host larva and the adults emerge at about the same time as those of *Loxostege*. In an experiment in which the parasites were forced out of diapause by keeping the host larvae at 85°F., the average date of emergence of the females was one day later than that of the males. Females comprised 37·9, 29·2 and 28·4 per cent. of the adults that emerged from overwintering material in 1941, 1942 and 1945, and only 60 of 162 adults reared in the laboratory were females. Both sexes survived for an average of about 17 days in the laboratory at 75°F. when provided with sugar, raisins and water, but the duration of adult life appeared to depend to some extent on the treatment of the overwintering material.

Adults were observed to pair on emergence, but unpaired females oviposited, the unfertilised eggs producing males. Females that emerged from cocoons

kept for some time at 85°F. sometimes oviposited immediately, but those from cocoons kept at 75°F. had a pre-oviposition period of about a week. Oviposition was stimulated by the presence of host larvae, or of frass or silk from them. As a rule, only one egg is deposited in a host ; if two are laid, only one larva completes its development. Newly-hatched larvae were readily attacked and parasites completed their development in them. Fully grown larvae were generally able to dislodge the female parasite unless held down, when parasitism succeeded ; in the field, the movements of the older larvae are restricted by their webs and attack may be more successful. Pupae and overwintering larvae removed from their cocoons were not attacked. Larvae about 1 cm. in length were the most suitable hosts for the parasites in the laboratory. The number of eggs laid per female varied considerably ; the maximum recorded was 258, laid over a period of 12 days. The egg is deposited in the body cavity of the host and hatches in 5–6 days, at which time it may be found adhering to the fat-body, with host tracheids spreading over it [*cf.* **24** 193]. The first-instar larva reaches its maximum size in 7–8 days, but does not moult until the onset of the physiological changes prior to pupation in the host, whether or not the latter has undergone diapause. The second-instar lasts about one day, and the third-instar larva emerges from the host and feeds through the hole from which it emerged. It becomes fully grown in 1–3 days and constructs a fine silken cocoon within that of the host, in which it pupates after a further 1–2 days. The total period within the cocoon before the emergence of the adult is 10–12 days.

Cremnops is usually the most abundant parasite reared from *L. sticticalis* and appears to exert important control in summer as well as in winter. Hyperparasites reared from it comprised *Mesochorus perniciosus*, Vier., which destroyed 41·7 per cent. in 1941, 18·8 per cent. in 1942 and 5·6 per cent. in 1945 and *Perilampus similis*, Cwfd., which was uncommon.

ROGERSON (J. P.). **The Oat Bird-cherry Aphis, *Rhopalosiphum padi*, L., and Comparison with *R. crataegellum*, Theo. (Hemiptera, Aphididae).**— *Bull. ent. Res.* **38** pt. 1 pp. 157–176, 8 figs., 16 refs. London, 1947.

The author states that closely allied species of *Rhopalosiphum* that infest cereals have been confused in both Europe and America. One of them is *R. prunifoliae*, Fitch, which he considers a synonym of *R.* (*Aphis*) *padi*, L. (since he does not adopt the view that *padi*, L., is the correct name for *Anuraphis helichrysi*, Kalt.), but it has been confused with two species that attack apple in winter. These are *R. crataegellum*, Theo., in England, and *R. annuae*, Oestl., and possibly *R. crataegellum* in the United States. He began a study of *R. prunifoliae* and *R. crataegellum* in England in 1940, when oats were heavily infested by grain Aphids throughout the northern part of the country, and gives full descriptions of the adults of all forms in the cycle and eggs of both species, with a list of their principal synonyms and notes on their biology.

The winter food-plant of *R. prunifoliae* in Britain is bird-cherry (*Prunus padus*), and, according to Börner, it occurs on bird-cherry in Europe, peach in Asia and *P. virginiana* in North America. It has been stated to overwinter also on wild cherry (*P. cerasus*), but was not found on many hundreds of wild-cherry bushes examined by the author, though some were close to heavily infested bird-cherry. The winter food-plants of *R. crataegellum* are apple, pear, *Sorbus* (*Pyrus*) *aucuparia* and *Crataegus oxyacantha*, and, less frequently, *S.* (*P.*) *aria*, *S.* (*P.*) *torminalis*, *Cotoneaster frigida* and *C. pannosa* ; it has also been recorded on medlar and quince. In Britain, it occurs chiefly on apple.

Both species oviposit on their winter food-plants in September–November, chiefly in October, and the fundatrices begin feeding in the buds in April and later collect on the lower surface of the young leaves. Those of *R. prunifoliae* mature in a fortnight and, after the fundatrigeniae appear, the leaves become

rolled downwards parallel to the mid-vein and later turn yellow and die. Apple leaves attacked by *R. crataegellum* become rolled loosely from tip to base, but do not change colour unless *Anuraphis roseus*, Bak. (*Yezabura malifoliae*, auct.) is also present. The fundatrigeniae of *R. prunifoliae* are apterous ; fundatrigeniae of *R. crataegellum* vary in form and also in number of generations, but all those observed in 1944–45 were alate. The alate migrants of both Aphids appear in May-June and disperse to various graminaceous plants, where the summer generations develop ; those of *R. prunifoliae* occur in the leaf-sheaths, on the lower stalks and, rarely, on the flowers and grain, and those of *R. crataegellum* on the roots and underground stems, the alates coming to the surface to fly to fresh plants. The gynoparae and males fly in autumn to the winter food-plant, where the oviparae are produced.

R. prunifoliae occurs in many parts of Britain, where in some years it is a serious pest of oats ; it was abundant in June and July 1940 and caused the plants to become distorted and stunted. Infestation in 1940–44 was heaviest in hill and semi-upland areas, where there is normally little arable land ; soil fertility and cultural conditions may not be adequate in these districts, and oats are generally sown later than elsewhere. The warm, dry spring of 1940, with no heavy rainfall, favoured migration and rapid colonisation, but rainfall was high and temperatures low during the migratory periods in 1941–44, and no serious attacks developed. Preliminary data indicate that weather during the autumn migration influences the extent to which the winter food-plants become infested. A method for forecasting the probable size of the spring colonies, based on the number of viable eggs on random samples of bird-cherry shoots representing 10 per cent. of the estimated total number per bush, was devised in 1943. Most of the eggs were on young wood. The total number on samples from four bushes in January–March 1944 varied from 533 to 4,119, and the percentage that was viable from 74·51 to 88·69. In the following November–December, the total number and percentage viable on these bushes were estimated at 111–1,680 and 65·71–74·69, respectively. The smaller populations are attributed to reduced reproduction in summer owing to wet, cold weather, as a result of which autumn migrants were scarce ; furthermore, many were probably destroyed by heavy rainfall in September–October. Counts at the end of February 1945 indicated that the number of eggs was lower on three of the bushes and the viability percentage on all, the figures being 160–1,417 and 28·75–62·38, respectively ; the reduction in viability is attributed largely to climatic conditions, though natural enemies and other factors may also be involved. A survey of the distribution of *Prunus padus* begun in 1943–44 indicated that it is a semi-upland species and most abundant in hill areas, corresponding with the localities in which *R. prunifoliae* was most numerous ; it is often an important component of farm hedges and also occurs in open woods and in parks and private grounds.

R. crataegellum is widely distributed throughout Britain, but it is of less importance as a pest of cereals there than *R. prunifoliae*. It causes considerable damage to apple, especially in orchards that are not regularly sprayed ; its feeding in the young shoots and flower trusses hinders fruit formation and sometimes causes the premature fall of fruitlets. It is controlled by an ovicidal wash applied in winter or by the use of contact insecticides as soon as the eggs hatch.

Webster (R. L.) & others. **Entomology.**—*Bull. Wash. agric. Exp. Sta.* no. 470 (55th Rep. 1944–45) pp. 36–40. Pullman, Wash., 1945.

Four years' observations on potato flea-beetles in the Yakima Valley, eastern Washington, have shown that adults of *Epitrix tuberis*, Gentner, began to emerge from hibernation in the first week of May. In 1945 emergence continued until 2nd September, with a maximum between 15th May and

15th June. Cage studies in the field showed three complete generations from adults emerging in May. It was confirmed that larvae of *E. subcrinita*, Lec., sometimes cause both surface and internal injuries to the tubers. Adults of this species appeared earlier than those of *E. tuberis*, but laid practically no eggs until May, and experiments showed that the first application of insecticide can safely be delayed until about 10th May. Satisfactory control of *Epitrix* on potatoes harvested before 15th July was obtained with four or five applications of dusts containing arsenical or fluorine compounds between 10th May and 15th June. With four applications, dusts of sodium, potassium or barium fluosilicate or of of calcium arsenate did not differ significantly in the extent to which they prevented infestation of tubers by the larvae, but significantly greater yields were obtained with sodium or potassium fluosilicate than with calcium arsenate. DDT dusts at various concentrations gave satisfactory control, but did not permit an extension of the intervals between applications.

Infestation of cultivated cherries by *Rhagoletis cingulata*, Lw., was fairly general in part of the Yakima Valley, though it did not occur in one district only seven miles from a place where wild bitter cherries (*Prunus emarginata*) were infested. The flies began to emerge in early June and were present until August. In laboratory and field tests of sprays, DDT in various combinations, lead arsenate, rotenone and cryolite were ineffective ; some control was obtained with phenothiazine, possibly only through repellent action, but it left an undesirably heavy residue.

In work on the biological control of the pea moth [*Cydia nigricana*, Steph.], *Macrocentrus ancylivorus*, Rohw., was liberated in 1945 in Whatcom county. It was not recovered in areas in which it had been released in 1943, but *Ascogaster quadridentata*, Wesm., was found to have become established in Whatcom county [*cf. R.A.E.*, A **34** 73]. Adults of *A. quadridentata*, *Glypta* sp. and *G. haesitator*, Grav., were collected in British Columbia and released in Whatcom and Skagit counties, and *Phanerotoma tibialis*, Hald., which seems to be the chief indigenous parasite of *C. nigricana* in these counties, and *A. quadridentata* were released on San Juan Island.

In 1945 the number and intensity of infestations by the pear psylla [*Psylla pyricola*, Först.] were further reduced in Washington, Oregon and Idaho, but in British Columbia outbreaks were found as far north as Vernon and in some cases increased in spite of control measures. The radius of spray areas was reduced from one mile to half a mile [*cf.* **34** 74].

Investigations into cases of poisoning of bees by insecticide dusts showed that cryolite was sometimes very toxic to them, the symptoms resembling those caused by calcium arsenate. In most cases the dust was brought into the hive mixed with pollen, and nurse bees and broods were killed. Weeds and sweet clover bordering potato fields were apparently the chief sources of poison ; on occasion, however, bees frequented dusted potato fields that had no flowers whatsoever, apparently gathering up the dust in place of pollen. Tests indicated that bees were not repelled for more than a few minutes by 2 per cent. cresol or carbolic acid added to dusts, or by nicotine.

Fischer (G. W.) & others. **Plant Pathology.**—*Bull. Wash. agric. Exp. Sta.* no. 470 (55th Rep. 1944–45) pp. 62–68. Pullman, Wash., 1945.

J. D. Menzies reports (p. 64) that further tests have confirmed the previous finding that the witches' broom virus disease of lucerne [*Chlorogenus medicaginis* of Holmes] is transmitted by the leafhopper, *Platymoideus acutus*, Say [*cf. R.A.E.*, A **34** 74]. It is assumed that other vectors also exist, since *P. acutus* was not found in the Methow Valley, where the disease was present.

Crowley (D. J.). **Cranberry-Blueberry Laboratory.**—*Bull. Wash. agric. Exp. Sta.* no. 470 (55th Rep. 1944–45) pp. 91–93. Pullman, Wash., 1945.

Work with sprays for the control of the cranberry fireworm [*Rhopobota naevana*, Hb.] and fruitworm [*Mineola vaccinii*, Ril.] was continued in Washington in 1945 [*cf. R.A.E.*, A **34** 75]. At concentrations of 3 lb. and 3 U.S. pints, respectively, per 100 U.S. gals., a spray powder containing 20 per cent. DDT with a wetting agent gave slightly better control of *R. naevana* than commercial preparations of 20 per cent. DDT in a light summer oil, apparently because the effect of the residue was more lasting. DDT spray applications three weeks apart were as effective as pyrethrum applied weekly. A spray containing 1 U.S. quart 20 per cent. pyrethrum concentrate and 3 lb. 20 per cent. DDT spray powder per 100 U.S. gals., applied just before the full-bloom stage, was very effective against *M. vaccinii*. The powdered form of DDT appeared safer at this stage of the crop than DDT in oil, which caused a trace of blossom injury. No unusual mortality of bees was noted; the set of berries in plots sprayed with DDT or DDT-pyrethrum mixture was equal to that in adjacent untreated plots. In an oil solution, the DDT spray killed adults of *Rhopobota* and *Mineola*, though not so readily as pyrethrum. In limited tests, piperine (1 pint to 100 gals. water) appeared more effective than pyrethrum or rotenone; it killed larvae and adults of *R. naevana* and adults of *M. vaccinii*.

A dormant spray of 10 lb. dry lime-sulphur and 1·5 U.S. gals. light summer oil, diluted with water to make 100 U.S. gals., gave control of the San José scale [*Quadraspidiotus perniciosus*, Comst.] on cranberry equal to that afforded by liquid lime-sulphur either with a dormant oil (3 : 100), or at standard dilutions, but caused some foliage injury.

Breakey (E. P.) & others. **Western Washington Experiment Station. Entomology.**—*Bull. Wash. agric. Exp. Sta.* no. 470 (55th Rep. 1944–45) pp. 119–125, 1 ref. Pullman, Wash., 1945.

A large portion of a light cherry crop was lost in 1935 in western Washington, particularly in King and Pierce counties, owing to infestation by *Rhagoletis cingulata*, Lw., and *R. fausta*, O.-S., which occurred in spite of control measures [*cf. R.A.E.*, A **34** 75], because heavy populations had built up in neglected or abandoned cherry orchards. Dried-up immature fruits of loganberry in Mason county were found to be infested with the Eriophyid mite, *Phyllocoptes gracilis*, Nal. [*cf. loc. cit.*]. Certain varieties of red raspberry escape infection with red-raspberry mosaic [*Marmor rubi* of Holmes] because the Aphid, *Amphorophora rubi*, Kalt., will not feed on them. Many hybrids resistant to this Aphid have been developed, and 2,505 seedlings obtained from them by inbreeding were tested for resistance in 1945. About 75 per cent. proved to be resistant.

Promising control of *Hylemyia cilicrura*, Rond., which has damaged seedling conifers, notably Douglas fir [*Pseudotsuga taxifolia*] [*cf.* **34** 76, 160] was obtained in preliminary tests with mercurous chloride (calomel), used as a 5 per cent. dust or as a suspension in water (1 oz. to 10 U.S. gals.); with a mixture of carbon bisulphide and mineral oil (1 : 1) made miscible with water and diluted (1 : 200) [*cf.* **29** 348]; and with DDT as a 3 per cent. dust in talc, as a suspension of 25 per cent. wettable powder (2 lb. per 100 U.S. gals. water), or as a 5 per cent. solution in a light mineral oil made miscible with water and diluted (1 : 400). The dusts were applied at the rate of 1 lb. per 100 feet of row, the liquids as a drench at 1 U.S. gal. per 50 feet of row. Two applications were made; one on 21st-22nd May, about six days after the first adults of *Hylemyia* were caught and when the seedlings were just beginning to appear, and the other on 4th–5th June. A new generation of flies apparently emerged

about 26th June. Four replications were made of each test ; the mercurous chloride proved toxic to the seedlings of Douglas fir but not to those of Port Orford cedar [*Chamaecyparis lawsoniana*] or spruce.

RANDALL (T. E.) & others. **Vegetable Seed Investigations, Mount Vernon, Washington.**—*Bull. Wash. agric. Exp. Sta.* no. 470 (55th Rep. 1944–45) pp. 142–151, 1 ref. Pullman, Wash., 1945.

This report from an experimental station concerned with vegetable seed crops, recently established at Mount Vernon, Washington, includes sections, all by E. C. Carlson, E. P. Breakey & R. L. Webster, on experiments against *Ceuthorrhynchus assimilis*, Payk., *Hylemyia brassicae*, Bch., and *Brevicoryne brassicae*, L., on cabbage (pp. 144–148). Dusts of mercurous chloride (calomel) and gypsum (1 : 19, 1 : 24 and 1 : 30 by weight) gave satisfactory control of *H. brassicae* in plant beds, even though re-applications were not made immediately after a rain or within 25 days of plant harvest [*cf. R.A.E.*, A **34** 73]. Under adverse conditions the dusts were superior to a suspension of 1 oz. mercurous chloride in 10 U.S. gals. water. A dust of 5 per cent. diphenylamine in gypsum gave similar control, and caused no injury beyond some blackening of the cortical tissue of the tap-roots, but when hydrated lime was substituted for gypsum in this dust, it stunted the plants and killed 50–60 per cent. of them. Plant beds isolated from the cabbage seed area were generally fairly free from *H. brassicae* at transplanting time, but infestation increased in them if cabbage was grown through two consecutive seasons.

In trials of possible substitutes for nicotine in the control of *Brevicoryne brassicae*, dusts containing rotenone, DDT, sabadilla, pyrethrum or a thiocyanate (lethane) were all unsatisfactory compared with a 3·6 per cent. nicotine dust, unactivated and stored for two weeks in a tight container, which gave an immediate knockdown of the Aphids and killed about 95–98 per cent. Dusting from aeroplanes gave generally inferior control. Detailed experiments were carried out in September on a field of cabbages transplanted in early August and having a moderate infestation of Aphids. Counts were made before and after dusting, which was done under adverse weather conditions (temperature 50°F. and moderate wind). The control percentages obtained were 94·6 and 94·1 for the 3·6 per cent. nicotine dust, activated with sodium hydroxide or with monohydrated copper sulphate, 57·8 for the same dust with hydrated lime only as a diluent, 86·7 for a proprietary dust of rotenone and nicotine alkaloid, 76·3 for a commercially prepared 10 per cent. nicotine alkaloid with a neutral carrier used at a concentration of 5 per cent. in hydrated lime, and 43·2 for a 5 per cent. DDT dust.

Of insecticides that showed promise against *Ceuthorrhynchus assimilis* in cages, PCH dust (pyrethrum and cyclohexanone in frianite) and 10 per cent. DDT dust were not effective in field plots, but a pyrethrum dust (Pyrocide 10) and a dust and a spray of synthetic cryolite reduced seed loss by 10·2, 12·9 and 8·5 per cent. respectively. A dust and spray of natural cryolite, however, and a sabadilla dust showed no promise. In field-scale tests on one-acre plots, pyrethrum dusts and dusts containing 75 per cent. lead arsenate and 75 per cent. calcium arsenate reduced the seed loss by 13·3, 12·3 and 5·6 per cent., respectively, and 3 per cent. DDT was completely ineffective. No plant injury was observed when a power duster was used, but lead arsenate heavily applied from a hand duster caused the blasting of blossoms and a reduction in seed set. Over all the seed-cabbage growing areas, 49 per cent. of the infested pods contained parasites, but it was clear that they neither reduced the seed loss nor controlled the weevil, except in so far as the following year's population was concerned.

Continuing observations on the seasonal development of *C. assimilis* [*cf.* **34** 76], C. F. Doucette reports (pp. 148–149) that in 1945 the first adults appeared

from hibernation in mid-April and pairing was observed five days later. Activity increased with the warmer weather in early May. The females seemed to prefer immature seed-pods for oviposition. Mature larvae were observed leaving pods of various crucifers from the end of May to the beginning of July ; in all cases the pods were approaching maturity. Under insectary conditions, the period from larval emergence from the pod to adult emergence from the soil ranged from 15 to 21 days. If the soil was allowed to dry, the insects generally failed to complete their development. The summer-emerging adults were active only long enough to obtain sufficient food ; this done, they went into hibernation. Considerable extensions are recorded in the range of the weevil in eastern Washington, Oregon and Idaho.

W. W. Baker & C. F. Doucette (p. 149) state that *Cydia* (*Laspeyresia*) *nigricana*, Steph., was reared in 1944 from *Lathyrus japonicus* and vetches (*Vicia sativa*, *V. angustifolia* and *V. gigantea*) from Whatcom and Skagit counties [*cf.* **34** 76]. This Tortricid is thought to attack at least 31 species of plants, distributed in seven genera. A list is given of 18 parasites that were reared from infested material and were probably parasitic or hyperparasitic on it. Its eggs on *Lathyrus sylvestris* were parasitised by *Trichogramma minutum*, Ril. (yellow race). Since 1942 no parasites have been observed attacking its larvae in any of the garden peas.

Heinrich (C.). **A new Species of *Keiferia* on Eggplant (Lepidoptera : Gelechiidae.).**—*Proc. ent. Soc. Wash.* **48** no. 2 pp. 35–36, 4 figs. Washington, D.C., 1946.

Descriptions are given of the characters distinguishing the adults and the male and female genitalia of *Keiferia peniculo*, sp. n., from those of *K. glochinella*, Zell., and *K. lycopersicella*, Busck, which it closely resembles. It infests egg-plant (*Solanum melongena*) and has been found in Texas, New Mexico and California.

Huckett (H. C.). **Timing Rotenone Applications for Control of the Pea Aphid on Long Island, with special Reference to Mosaic Incidence.**—*Bull. N.Y. agric. Exp. Sta.* no. 713, 30 pp., 8 figs., 24 refs. Geneva, N.Y., 1945.

The following is based on the author's summary and conclusions. Investigations on Long Island during 1939–44 showed that *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) was much more injurious to peas at Hicksville, in the western part of the island, than at Riverhead, in the east. The winged Aphids appeared on the crop a week or two earlier in the west than in the east and infestation increased more rapidly during the rest of the season, probably owing to the earlier advent of warm weather. Infection with mosaic viruses was also more prevalent and more injurious at Hicksville. A marked increase in Aphid infestation and of mosaic symptoms (evidently due to transmission by Aphids from plant to plant within the fields) invariably occurred during the blooming and fruiting period. In neither locality were the circumstances naturally favourable for production of full yields of early peas, chiefly owing to the frequent occurrence of spells of unfavourable weather during the blossoming period, and this restricted the increase in yield due to insecticidal treatment.

The treatments comprised a derris spray in 1939–41 and a dust (or occasionally a spray) of cubé in 1942–44 ; they were applied on one or more of five dates of which the third was about the date on which flowering began. At Hicksville, the increase in average yield of pods during 1939–44 was 26·9 per cent. on plots that received one application at about the beginning of flowering, and the further increase due to additional applications was not more than 5·5 per cent., probably partly because of the inhibiting influence of weather and soil conditions on productivity during the blossoming period. The percentages of

plants showing symptoms of mosaic disease towards the close of the season in 1941, 1943 and 1944 averaged 9·3 in plots that had received one application at about the beginning of flowering, 10·76 in plots receiving one application 7–10 days earlier, 6·9 and 7·19 in plots that received the first four and all of the five applications, and 17·77 on untreated plots, indicating that the applications that gave the highest increase in yield were also of slight benefit in restricting the apparent extent of mosaic disease.

At Riverhead, the results were largely negative, owing to the lightness of Aphid infestation and its retarded development during the season as compared with crop growth. Mosaic infection, as indicated by plant symptoms, was also generally light, except in three instances in which a noticeably higher proportion of infected plants was observed in certain sowings that had produced poor stands. Treated plots in this district showed average increases in yield of 1·7–7·9 per cent. over untreated ones. The average increase in plots that received one application at about the beginning of flowering was 6·1 per cent.

It is concluded that a dust of derris or cubé (5 per cent. rotenone), diatomaceous earth and talc (15 : 5 : 80 by weight) or a spray of 6 lb. derris or cubé powder (5 per cent. rotenone) and ½–1 lb. wetting agent per 100 U.S. gals. water should be applied at about the beginning of flowering for the protection of early market-garden varieties of peas. This application not only gives the best control of the Aphid, but also tends to restrict the extent of mosaic infection. Dusting should be carried out when the air is calm and the leaves moist or damp ; the whole plant should be enveloped in the dust cloud, but particular attention should be paid to the buds and terminal growth, where Aphids are likely to congregate. Sprays should also be applied when the air is calm, and the nozzles should be sufficiently numerous and so placed as to give coverage. It is more important that the insecticide should be applied under satisfactory weather conditions than that it should be applied promptly under less satisfactory ones, particularly in the case of a dust. Rain soon after treatment would probably necessitate a second application within a week.

LANGFORD (G. S.), Ed. **Entoma. A Directory of Insect and Plant Pest Control.** 6th edn., 320 pp. College Park, Md., Eastern Br. Amer. Ass. econ. Ent., 1945. Price $1.00.

In addition to the information in earlier editions of this directory [*cf. R.A.E.* A **32** 77, etc.], the sixth includes brief notes on the production and export of insecticides, fungicides and disinfectants in the United States, and lists of addresses of officials of State organisations connected in various ways with pest control.

Forest Entomology.—*Rep. Dep. Lds For. N.S. 1945* pp. 35–55, 3 maps. Halifax, N.S., 1946.

There were no records of unusual insect activity in forests in Nova Scotia in 1945. *Gilpinia hercyniae*, Htg., was still the most important defoliator of spruce, but was not numerous in most localities. Disease apparently attacked the larvae in most of the Province [*cf. R.A.E.*, A **34** 129, etc.] and is probably controlling the sawfly. A heavy outbreak of *Dendroctonus piceaperda*, Hopk., that had been in progress for several years and had already killed much spruce in Hog Island, Yarmouth County, and an infestation in Cape Breton Island were reported.

Infestation of larch by *Coleophora laricella*, Hb., was again less severe [*cf. loc. cit.*], but *Alsophila pometaria*, Harr., was more injurious than in 1944, and defoliated various forest trees as well as unsprayed apple trees. Brown foliage on alder, due to skeletonising by *Haltica* (*Altica*) *ambiens* var. *alni*, Harr., was common in many parts of the Province. *Cryptococcus fagi*, Baer., and the

fungus, *Nectria* [*coccinea*], associated with it [*cf.* **22** 497] have killed much of the old stand of beech, but some trees appear to have been immune. The Coccid is still present in beech stands in small numbers, but does not seem to be having a serious effect on young growth. Infestations of birch by *Coleophora salmani*, Heinr., *Bucculatrix canadensisella*, Chamb., *Fenusa pusilla*, Lec. (*pumila*, Klug) and *Phyllotoma nemorata*, Fall., were light. Further investigations on dieback of birch [*cf.* **34** 130] indicated that factors other than attack by *Agrilus anxius*, Gory, are responsible for the condition, the borer merely contributing to the eventual killing of the tree. Several species of fungi found in decadent trees are recorded.

Insects attacking shade trees included *Stilpnotia salicis*, L., which completely defoliated willow in one locality, *Orgyia* (*Notolophus*) *antiqua*, L., and *Hemerocampa leucostigma*, S. & A., which were present in only normal numbers [*cf.* **34** 130], and *Popillia japonica*, Newm., which was found only in Halifax, where control measures seemed to be effective.

Beneficial insects liberated during the year comprised *Chrysocharis laricinellae*, Ratz., and *Agathis* (*Bassus*) *pumila*, Ratz., against *Coleophora laricella*, *Dahlbominus* (*Microplectron*) *fuscipennis*, Zett., *Exenterus amictorius*, Panz., and *Sturmia* sp. against *G. hercyniae*, and *Mantis religiosa*, L., as a general insect predator.

The work of the Forest Insect Survey during the year in Nova Scotia is very briefly described.

Wilson (F.). **The Use of Mineral Dusts for the Control of Wheat Pests.**—*Bull. Coun. sci. industr. Res. Aust.* no. 199, 31 pp., 1 pl., 8 figs., 9 refs., multigraph. Melbourne, 1946.

The following is based on the author's summary of this account of one large-scale and two small tests carried out in a bulk-wheat depot in Victoria to determine the effectiveness of magnesite and dolomite dusts in preventing insect infestation when used as barriers on the surface of the wheat and a discussion of the factors that have determined the extent to which dusts have been employed in Australia during the war and other practical aspects of the use of dusts for the protection of stored grain [*cf. R.A.E.*, A **33** 318–319; **34** 230–231]. *Rhizopertha dominica*, F., was the principal insect present, and the main test lasted about a year. The dusts were used at rates of 0·19, 0·58, 1·15 and 1·54 per cent. by weight of the top six-inch layer of wheat (1, 3, 6 and 8 tons per million bushels bulk in the depot under consideration). Magnesite at the three highest rates noticeably reduced the rate of infestation, and dolomite was less effective [but *cf.* **33** 372]. After one year, the ratios of living insects in dusted and undusted grain were 2 : 300 and 11 : 300 for 1·54 and 1·15 per cent. magnesite and 33 : 300 for 1·54 per cent. dolomite. The surface barrier gave about the same result whether the dust was raked into the top six inches of wheat or not; there was evidence that a raked barrier permitted more adults to enter the wheat, but gave a greater kill of the resulting adult progeny. The degr ee of heating in the wheat varied inversely with the degree of control exercised by the dosage used [*cf.* **35** 192]. A dust barrier did not cause infestations to become more deep-seated, and it considerably reduced the risk of serious damage from the explosion of wheat dust. At 5 tons dust per million bushels, the cost of treatment, including labour, is about 3d. per 100 bushels.

In small tests, the treatment of infested areas with magnesite or dolomite did not give results of commercial value. At the dosages used commercially and in the tests, these dusts are of preventive value only, and their use must be supplemented by local surface fumigation of infestations that develop in spite of the barrier. In one instance, the combined use of a dust barrier and local fumigation completely protected a mass of over three million bushels for three years.

The main problem experienced in the commercial use of magnesite or dolomite in bulk depots was the increase in the dustiness of the atmosphere as the wheat was removed, but it was not acute and the dust apparently caused no danger to health. An increase in the dosage of dust used commercially would further reduce infestation, but would accentuate the problem of a dusty atmosphere. The property of slow settling is undesirable in the dusts, and their more intensive use probably depends on the employment of a method, such as pneumatic suction, that would reduce the amount of floating material.

Apart from Victoria, dusts have been used commercially in Australian wheat storages only in Western Australia, where diatomaceous earth was employed to a limited extent in bulk depots. The total treatment of grain with mineral dusts would be uneconomic for Australian bagged wheat, which can be treated by fumigation [*cf.* **33** 319], or for wheat in Victorian silos, where there is no insect problem ; it might possibly be justifiable for wheat in silos in New South Wales, where the position is less satisfactory, but would give rise to a formidable dust problem in the tunnels when the silos were emptied.

Miles (H. W.), Finney (D. J.) & Anscombe (F. J.). **Insecticidal Dusts against Flea Beetles. Report from the Conference of Advisory Entomologists.**—*Agriculture* **53** no. 2 pp. 58–66, 1 pl., 2 refs. London, 1946.

Experiments in the control of flea-beetles [*Phyllotreta*] on seedling crucifers by means of dusts were carried out in many parts of England and Wales in 1944 and 1945, and the results are here discussed ; some of those obtained in the first year have already been noticed [*R.A.E.*, A **34** 256]. The dusts used in 1944 comprised DDT (5 per cent.) and PP. 666 (0·26 per cent. γ isomer of benzene hexachloride), both at 30 lb. per acre, a derris dust (0·5 per cent. rotenone) at 40 lb. per acre, and finely-ground low-grade basic slag at 112 lb. per acre. They were applied from a wheeled dusting machine, which is described, during the warm part of the day, as soon as the seedlings (swedes, turnips, rape or kale) had appeared in appreciable numbers. The experiments were carried out at 128 centres, and the full range of dusts was used at about half of them. A special trap, which is also described, was devised for making counts of flea-beetles, and the average numbers per 10 ft. of crop row in the plots that received the full range of dusts were 2·4, 4·8, 3·4 and 8·0 after treatment with DDT, derris, PP. 666 and basic slag, respectively, as compared with 9·5 in the controls. There was thus little difference in the effectiveness of the three insecticide dusts.

Comparison of the numbers of plants that became established on unit areas did not prove satisfactory in all cases owing to the variations in flea-beetle populations, and the trials were therefore classified according to whether the average number of beetles per 10 ft. of row did or did not exceed 10. In 128 trials, the average numbers of plants per 10 ft. of crop row in plots dusted with DDT, derris, PP. 666 and basic slag or left untreated were 73, 65, 67, 65 and 61 for the lower range of infestation, and 77, 83, 78, 70 and 66 for the higher one, showing that although DDT, derris and PP. 666 afforded a greater degree of protection when beetles were commoner, flea-beetle attack did not actually effect a great reduction in the plant population. Differences in the effectiveness of the first three dusts were again not apparent. When swedes, turnips and kale were graded into successfully established crops and those that were doubtful or failures, the results from 66 localities in which all four dusts were used showed 56, 54, 55, 46 and 20 successful plots out of 66 in each case for DDT, derris, PP. 666, basic slag, and no treatment, respectively. It was again evident that the first three dusts were beneficial where flea-beetles were numerous, with little to choose between them.

In 1945, only DDT and PP. 666 were used, both at 40 lb. per acre, and in addition to the machine mentioned above, knapsack dusters, perforated hand-shakers and hand bellows were employed. No flea-beetle counts were made.

In 116 trials, DDT gave 100 successful crops and PP. 666 gave 105, as compared with 76 for no treatment. When the unsuccessful crops in the controls were compared with the corresponding dusted ones, it was apparent that dusting saved about half the crops that would otherwise have failed and improved the condition of some of the doubtful ones. Some of the failures on treated plots were due to weather or cultural faults. The average weights of seedlings and the numbers per 20 ft. of drill in plots treated with DDT and PP. 666 were 0·66 and 0·64 gm., respectively, and 186 (in both cases) for kale, as compared with 0·52 gm. and 154 for no treatment, and 0·62 and 0·59 gm. and 217 for swedes and turnips, as compared with 0·52 gm. and 190.

The results as a whole, whether measured in terms of number of beetles, plant-protection, seedling weight and quality or yield clearly demonstrated the value of dusting crucifer seedlings with insecticides, and this is recommended as a matter of routine. The average yields of swedes and kale in tons per acre were 25·3 and 20·4 on untreated plots and 28·4 and 24·0 on dusted ones. Flea-beetle attack is most severe on crops sown from mid-April to mid-May, and early-sown kale often escapes attack, but as it is sometimes severely injured, preparations for dusting it should not be omitted.

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